



Design Guide
netRAPID Chip Carrier

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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1 Introduction

1.1 About this document

This design guide describes the mechanical and electrical interfaces of netRAPID products. This document includes the description of the netRAPID Evaluation Boards.

1.2 List of revisions

Rev	Date	Name	Chapter	Revision
5	2015-04-16	HH	4.1	Section <i>Pin assignment</i> : Specification of pin DPM_SIRQn updated.
		HH	4.2.2	Section <i>PE and ground signal</i> added.
		HH	4.2.5	Section <i>Host interface mode</i> : Table 7: netRAPID internal pull-up and pull-down resistors updated.
		HH	4.3.1	Section <i>Address bus and data bus</i> : Correction of 8 and 16-bit mode.
		HH	6.1.1	Section <i>Connections overview</i> : Do not connect FB4 and FB5 for NRP 10-CCS (Figure 15).
6	2016-03-21	HH	7.5.1	Correction: DPM_WRn signal is at pin 16.
7	2017-08-27	HH, RG	2	Section <i>Product overview</i> : NRP 51-RE added. Comparison NRP 51-RE and NRP 52-RE.
			2.1.3	Section <i>NRP 51-RE and NRP 51-RE/F8T</i> added.
			3.2.1	Section <i>Footprint</i> : NRP 51-RE added.
			4.1	Section <i>Pin assignment</i> : Pin 14 has SPM_DIRQn and pin 15 has SPM_SIRQn. NRP 51-RE added.
			4.2.2	Section <i>PE and ground signal</i> : NRP 51-RE added.
			4.4	Section <i>Serial dual-port memory mode</i> : Figure 14 updated.
			6.3	Section <i>NRP 51-RE</i> added.
			7.2	Section <i>Evaluation Board NRPEB 51-RE</i> added.
			7.5.1	Section <i>Host interface (X1/X104)</i> : Pin 18 for NRPEB 51-RE added. SPM_SIRQn and SPM_DIRQn added.
			7.5.2	Section <i>Host interface measuring pins (X2/X105)</i> : SPM_SIRQn and SPM_DIRQn added.
			7.5.5	Section <i>Host interface mode NRPEB 51-RE (S203, S204, S300, S301)</i> added.
			7.5.9	Section <i>SPM Interface NRPEB 51-RE (X300)</i> added.
			7.5.10	Section <i>USB interface for SPM - NRPEB 51-RE (X400)</i> added.
			8.3.1, 8.3.2, 8.3.4	Section <i>Technical data: netRAPID Chip Carrier NRP 51-RE, netRAPID Chip Carrier NRP 51-RE/F8T (preliminary), and Evaluation Board NRPEB 51-RE</i> added.
			9.3	Section <i>NRPEB 51-RE</i> added.
10.3	Section <i>NRPEB 51-RE</i> added.			
All	NRPEB-CCS renamed to NRPEB 10-CCS, NRPEB-DPS renamed to NRPEB 10-DPS, and NRPEB-RE2 renamed to NRPEB 52-RE.			

Table 1: List of revisions

1.3 References to documents

This document refers to the following other documents:

- [1] Hilscher Gesellschaft für Systemautomation mbH: Getting Started Guide, Serial Dual-Port Memory Interface with netX, Revision 4, English, 2015-04.
- [2] Hilscher Gesellschaft für Systemautomation mbH: Technical Data Reference Guide, netX 10, Revision 0.9, English, 2011-12.
- [3] Hilscher Gesellschaft für Systemautomation mbH: Technical Data Reference Guide, netX 51/52, Revision 3, English, 2017-08.
- [4] Hilscher Gesellschaft für Systemautomation mbH: Dual-Port Memory Interface Manual, netX based products, Revision 12, English, 2012.

2 Product overview

netRAPID chip carriers are for easy and fast integration into a host system:

- Fully functional 32 x 32 mm chip carrier that can be soldered directly on a PCB of the host system,
- for a direct network connection, only a connector on PCB is needed,
- parallel dual-port memory or serial dual-port memory (fast SPI slave interface),
- LEDs,
- address switches.

Hardware development is confined to connect the network connector, the LEDs and possibly an address switch. The interface from the host system to the netRAPID device is either a parallel dual-port memory interface or a serial dual-port memory interface by means of a fast SPI connection.

The netRAPID can be soldered manually onto the host system and simplifies prototype production. For series production netRAPID can be soldered onto a host system PCB using SMD.

Steps

1. Start with the Evaluation Board. Each Evaluation Board is equipped with a soldered-on netRAPID to start evaluation immediately.



Figure 1: Evaluation Board, 3 pcs. netRAPID and Evaluation DVD with software tools

The netRAPID Evaluation DVD contains limited versions of Loadable Firmware (LFW) for testing and evaluation purposes, software tools for configuring the netRAPID, for downloading firmware and for testing I/O communication, C-Toolkit (source code for developers of non-Windows target platforms and embedded systems), USB drivers for Windows (needed for accessing the USB diagnostic interface of the netRAPID from a Windows configuration PC), cifX Device Driver (needed for accessing the host interface of the netRAPID from a Windows PC via PCI), PDF documentation for users and developers.

2. Three netRAPID devices are included the netRAPID Evaluation Board. Create your host system and simply solder the netRAPID device onto your host system manually and have your first prototype done.
3. Start your series SMD production of your host system with netRAPID devices from a tray containing 24 pcs.



Figure 2: netRAPID tray containing 24 pcs. for series production

Overview

Products	Description	Part number
CC-Link Slave		
NRPEB 10-CCS	Evaluation board including NRP 10-CCS	7600.740
NRP 10-CCS (TRAY)	24 pieces of NRP 10-CCS Chip Carriers	7652.740
NRPLFW-CCS	Loadable CC-Link Slave Firmware for NRP 10-CCS	7601.740
PROFIBUS DP Slave		
NRPEB 10-DPS	Evaluation board including NRP 10-DPS	7600.420
NRP 10-DPS (TRAY)	24 pieces of NRP 10-DPS Chip Carriers	7652.420
NRPLFW-DPS	Loadable PROFIBUS DP Slave Firmware for NRP 10-DPS	7601.420
Real-Time Ethernet (Slave)		
NRPEB 51-RE	Evaluation board including NRP 51-RE\F8T	7600.100
NRP 51-RE\F8T (TRAY)	24 pieces of NRP 52-RE\F8T Chip Carriers (8 Mbyte serial Flash and TPM 1.2) planned	7662.100
NRP 51-RE (TRAY)	24 pieces of NRP 52-RE Chip Carriers (4 Mbyte serial Flash)	7662.101
NRPEB 52-RE	Evaluation board including NRP 52-RE	7600.200
NRP 52-RE (TRAY)	24 pieces of NRP 52-RE Chip Carriers	7672.100
NRPLFW-ECS	Loadable EtherCAT Slave Firmware	7601.120
NRPLFW-OMB	Loadable Open Modbus/TCP Firmware	7601.860
NRPLFW-PNS	Loadable PROFINET IO-Device Firmware	7601.850
NRPLFW-EIS	Loadable EtherNet/IP Adapter Firmware	7601.830
NRPLFW-S3S	Loadable Sercos Slave Firmware	7601.160
NRPLFW-PLS	Loadable POWERLINK Controlled Node Firmware	7601.180
NRPLFW-VRS	Loadable VARAN Client Firmware	7601.810

Table 2: Product overview

Comparison of netRAPID with Ethernet

The main difference between NRP 51-RE and NRP 52-RE is that

- NRP 52-RE has magnetics on the chip carrier while using
- NRP 51-RE the magnetics has to be on the host system.

NRP 52-RE has a minimum space requirement on the host system.

Another difference between NRP 51-RE and NRP 52-RE is that NRP 51-RE has SDRAM on the chip carrier. Thus, the firmware of NRP 51-RE offers more functionality e.g. integrated web server and NDIS interface. The firmware of NRP 52-RE uses the internal RAM only.

NRP 51-RE is available in two variants. Compared to NRP 51-RE, NRP 51-RE\F8T has additional 4 MByte Flash memory (8 MByte in sum) and has a TPM (Trusted Platform Module) on the chip carrier.

netRAPID	Magnetics	Flash size	SDRAM	TPM
NRP 51-RE	-	4 MByte	8 MByte	-
NRP 51-RE\F8T	-	8 MByte	8 MByte	✓
NRP 52-RE	✓	4 MByte	-	-

Table 3: Comparison of netRAPID with Ethernet

Interface overview

The subsequent table lists interfaces and functions of the netRAPID Chip Carriers which are currently supported by the licensed netRAPID Standard Loadable Firmware (NRPLFW). Note that customized netRAPID firmware with extra functionalities will be available from Hilscher on request.

Standard functions		NRP 10-DPS	NRP 10-CCS	NRP 51-RE	NRP 52-RE	Remark
Host interface	8 bit parallel dual-port memory	✓	✓	✓	✓	-
	16 bit parallel dual-port memory	✓	✓	✓	✓	-
	Serial dual-port memory (SPI)	✓	✓	✓	✓	-
Communication interface	PROFIBUS DP (Slave)	✓	-	-	-	-
	CC-Link (Slave)	-	✓	-	-	-
	Real-Time Ethernet (Slave)	-	-	✓	✓	-
Diagnostic interface	USB	✓	✓	✓	✓	Default: USB is activated.
	UART	-	-	-	-	Default: UART is deactivated. The pins of the UART interface are shared with the pins for the SYNC interface.
Production interface	JTAG	-	-	-	-	For Hilscher development and production only.
Input	2x 4 bit (address switch)	✓	✓	-	-	-
	1x 4 bit (baud rate switch)	-	✓	-	-	-
Output	1 bit GPIO	-	-	-	-	Standard firmware does not use the GPIO.
SYNC interface	SYNC0, SYNC1	-	-	✓	✓	Default: SYNC is activated The pins of the SYNC interface are shared with the pins for the UART interface.
LED	SYS-LED	✓	✓	✓	✓	-
	COM0, COM1	✓	✓	✓	✓	-
	Link and Act	-	-	✓	✓	-

Table 4: Interface and standard functions overview

2.1 Block diagrams

2.1.1 NRP 10-CCS

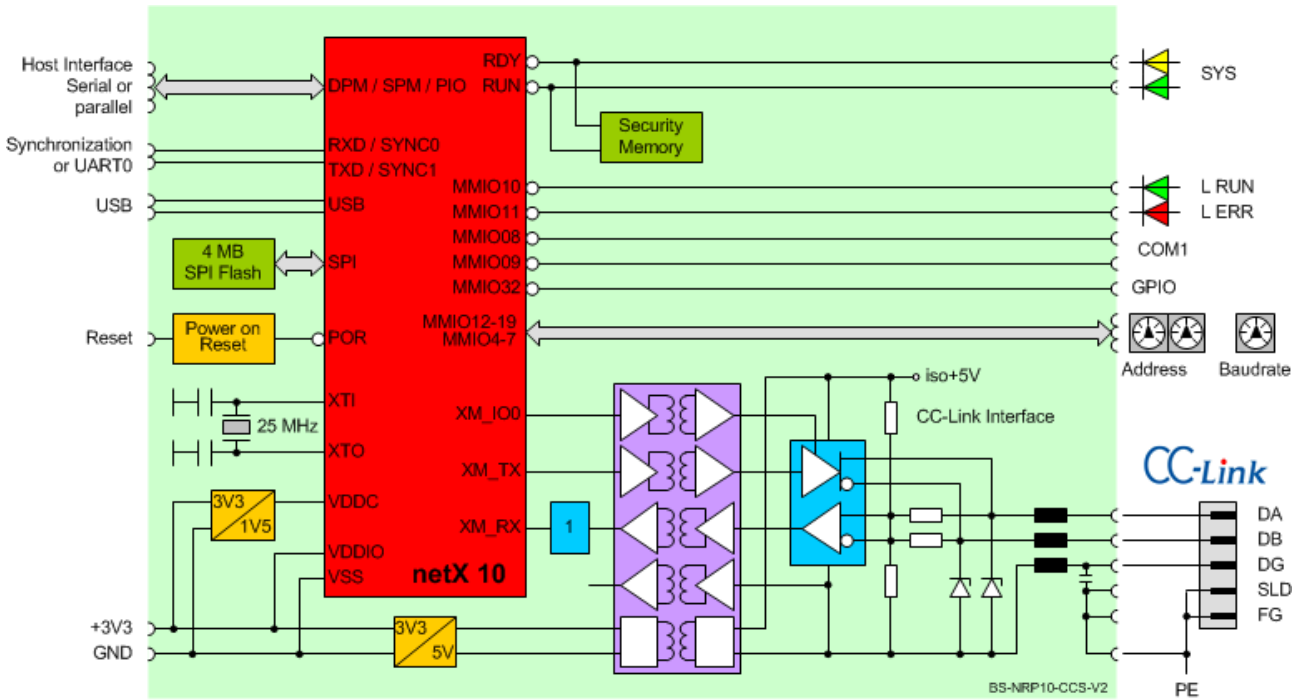


Figure 3: NRP 10-CCS block diagram

2.1.2 NRP 10-DPS

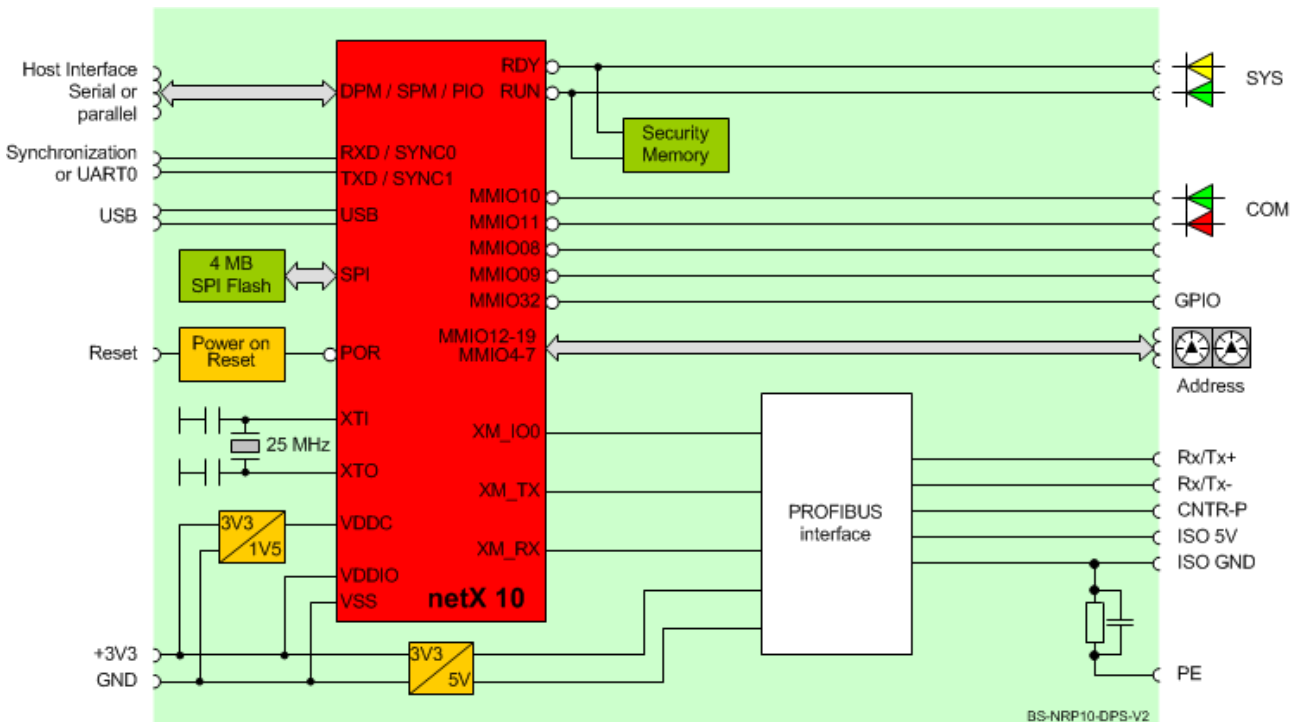


Figure 4: NRP 10-DPS block diagram

2.1.3 NRP 51-RE and NRP 51-RE/F8T

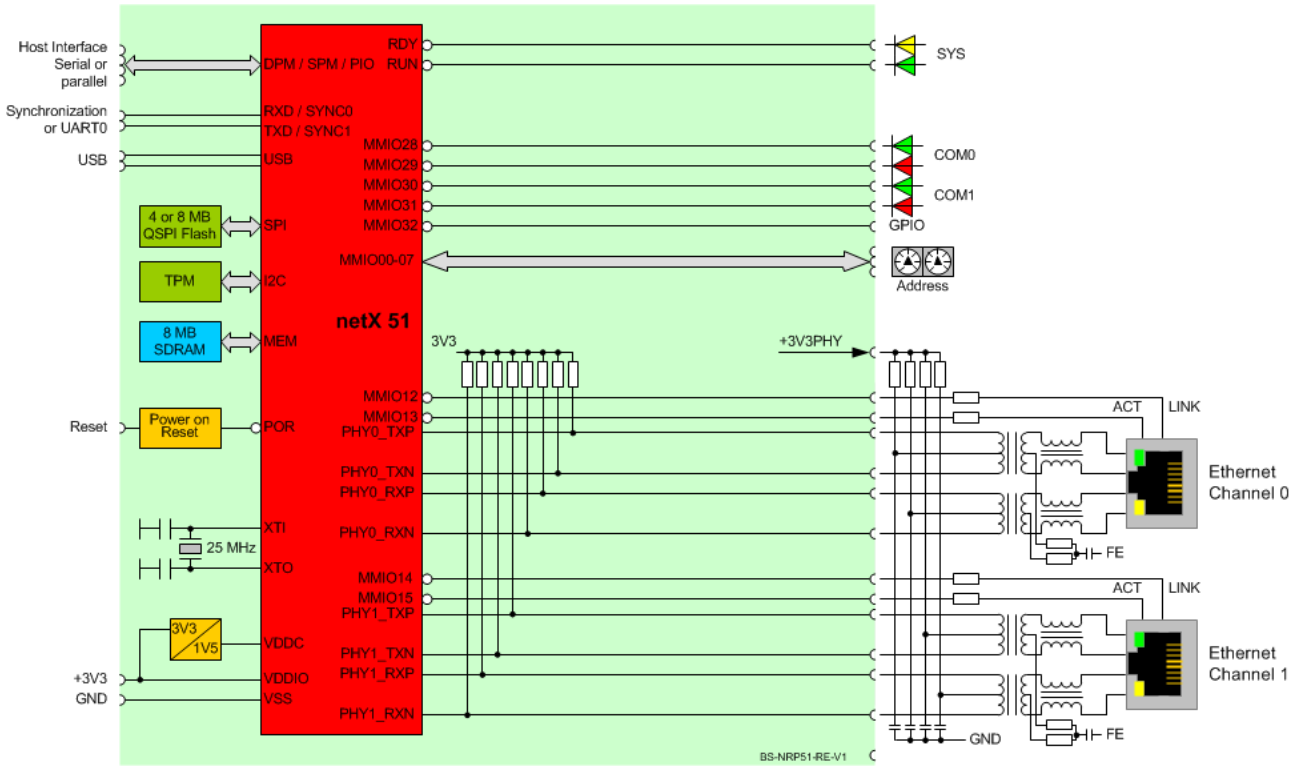


Figure 5: NRP 51-RE / NRP 51-RE\F8T block diagram

NRP 51-RE has 4 MByte Flash and no TPM chip.

NRP 51-RE\F8T has 8 MByte Flash and a TPM chip.

2.1.4 NRP 52-RE

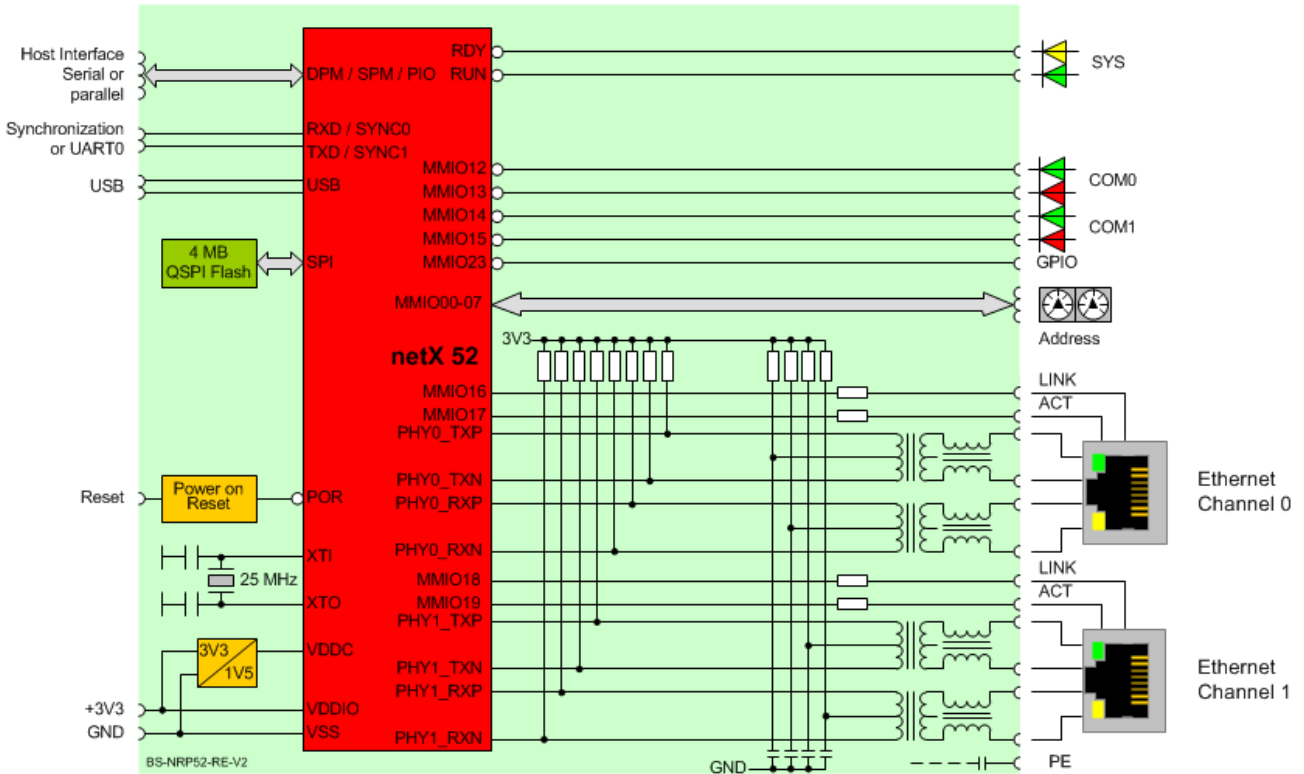


Figure 6: NRP 52-RE block diagram

3 Mechanics

3.1 Dimension

A netRAPID has the following dimensions: L= 32 mm, W = 32 mm and H = 4 mm.

3.2 Design guidelines for the host system

3.2.1 Footprint

The layout for the netRAPID footprint on the host system requires the following dimensions. Each chip carrier has its own footprint.

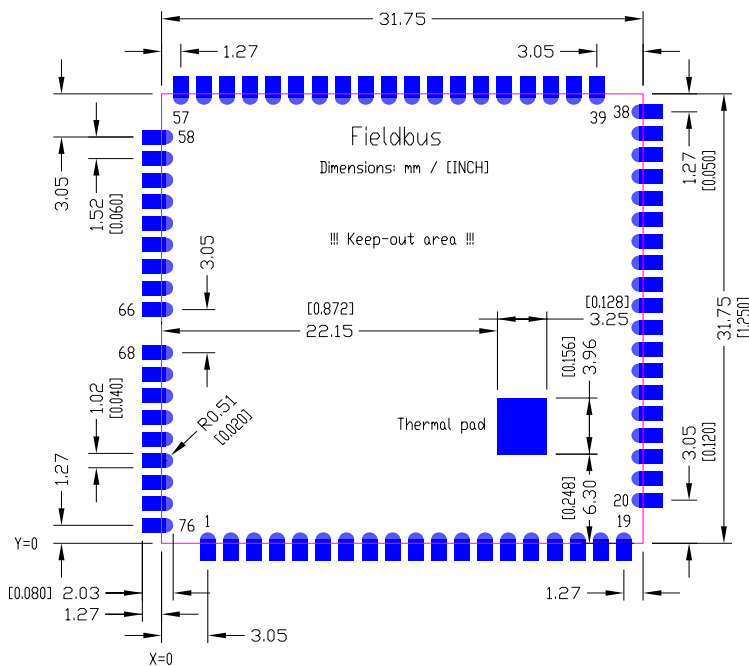


Figure 7: Footprint NRP 10

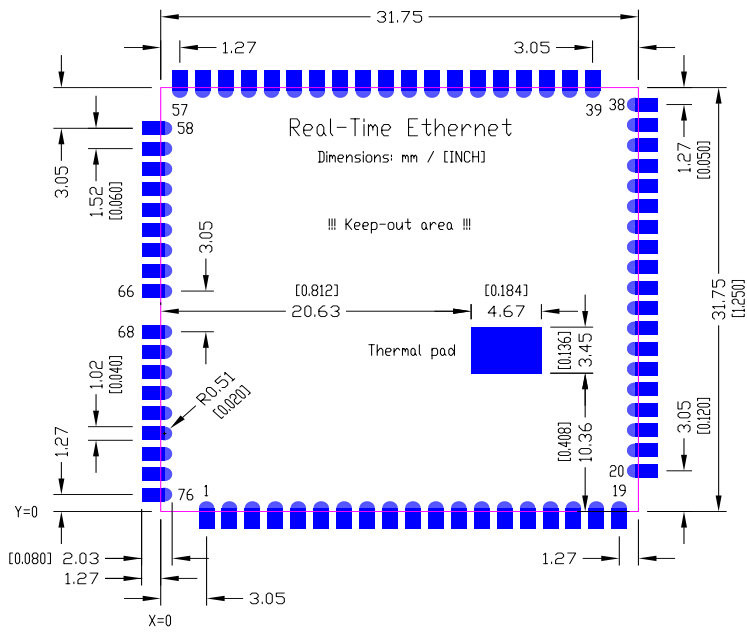


Figure 8: Footprint NRP 51

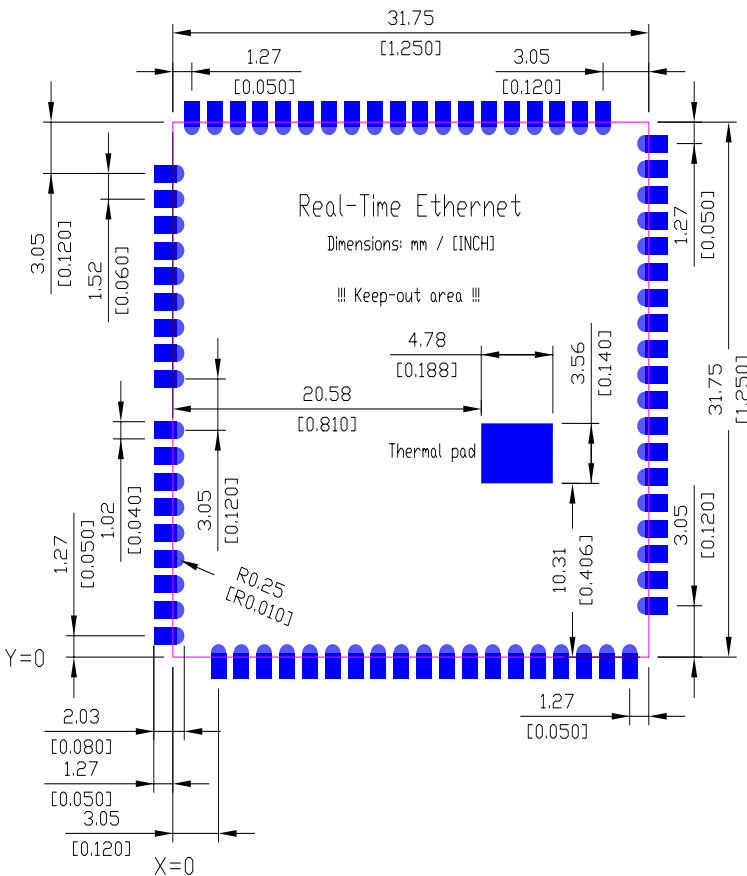


Figure 9: Footprint NRP 52

3.2.2 Thermal behavior and thermal pad

NRP 10 devices have a power consumption of 1 - 1.2 W and NRP 51/52 devices of 1.8 W, which generates heat. The generated heat must be dissipated to prevent overheating of the chip. While there is a hard limit for the chip's junction temperature at 125°C above, which malfunction and permanent damage may occur, it is always desired to keep the junction temperature as low as possible, as a semiconductor's statistical life time generally decreases with rising temperature.

Make sure that the case temperature of the netX **is always below 100°C**, which is the recommended maximum value for a netX design. This value was chosen because the FIT-rate for the silicon process, which netX are based on, shows a significant rise in the temperature range between 100°C and the absolute maximum junction temperature. However, since the absolute max. junction temperature is 125 °C, it is at the device manufacturer's discretion if he wants to follow this recommendation or rather decides to accept a higher junction temperature and trade a decrease of the MTBF of his devices for a higher temperature range specification.

netRAPID devices have a thermal pad at the bottom for heat dissipation to the PCB of the host system.

Important note: You **must** use a thermal pad on the PCB for the host system. This is absolutely necessary in order to reach the temperature range for netRAPID devices.

This results in requirements for the PCB of the host system:

- Use at least 9 vias, which are to be connected to ground plane.
- Use a large copper surface on the PCB of the host system to achieve a good heat dissipation for the netRAPID.
- Don't place components on the PCB of the host system below the netRAPID to avoid heat dissipation of other component than netRAPID.

The thermal pad of the netRAPID device has GND potential.

Figure 7 on page 12 shows position and size of the thermal pad for NRP 10 and Figure 8 on page 13 shows it for NRP 51/52.

3.2.3 Keep-out area

Make sure that no vias and no wires are on the PCB of the host system underneath the netRAPID device.

Important note: Make sure to use the thermal pad. Figures in section *Footprint* on page 12 shows position and size of the thermal pad each netRAPID.

3.3 Tempering, storage and soldering

Tempering

netRAPID have to be tempered to reduce unwanted moisture before they are soldered onto the host system. If the moisture is not reduced then the heating during the soldering process to more than 200°C can lead to possible destruction of electronic parts of the netRAPID. To avoid this, netRAPID have to be tempered 24 h at 80°C.

Hilscher tempers netRAPID devices before they are shipped. After tempered, netRAPID devices are shipped welded in a tray.

Moisture sensitivity level

The Moisture Sensitivity Level (MSL) is MSL 3, 168 h, 30°C / 60%RH.

Storage

The netRAPID in a welded (sealed) tray can be stored up to 1 year. After 1 year the netRAPID devices have to be tempered again, before soldered onto a host system.

Soldering

netRAPID devices can be placed on the PCB of the host system for SMD production. netRAPID can be picked and placed (from the tray to the PCB of the host system) using asymmetric suck in. Place netRAPID on the top side of the PCB of the host system.

Important note: The thermal profile for reflow soldering depends on the used soldering paste and the used reflow system. Read the data sheet of the manufacturer of the used soldering paste for requirements to the thermal profile.

When using the Heraeus soldering paste Sn/Ag/Cu-95.5/4/0.5 (F620CU0.5-88M3 lead free) then the following thermal profile is recommended:

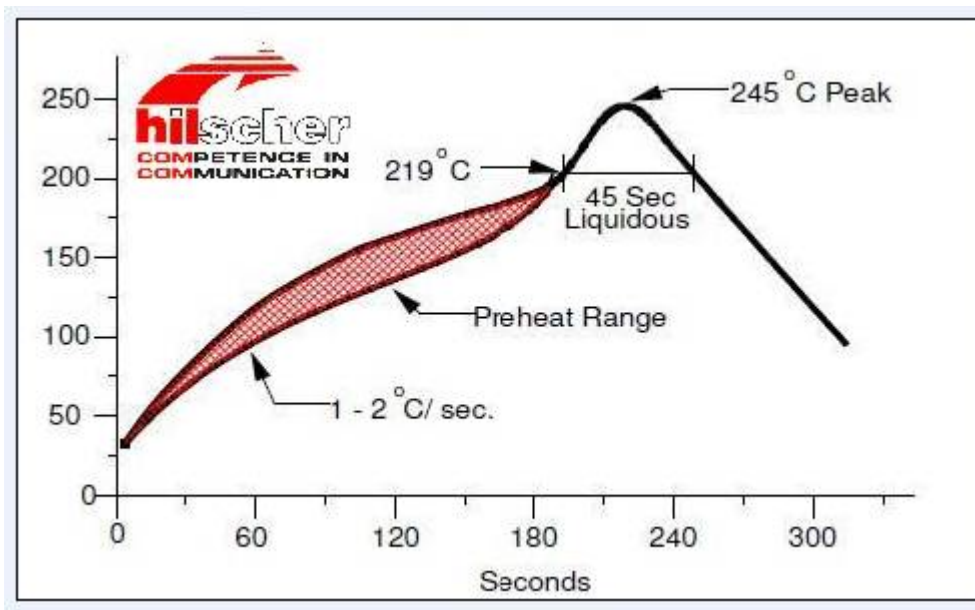


Figure 10: Thermal profile for reflow soldering

Adhesion keeps the components on the netRAPID in place during the reflow soldering.

3.4 Matrix label

A matrix label is on the device for identification. It contains 3 items:

1. Part number
2. Hardware revision
3. Serial number

The figure shows part number 7600.100, hardware revision 2 and serial number 20000.

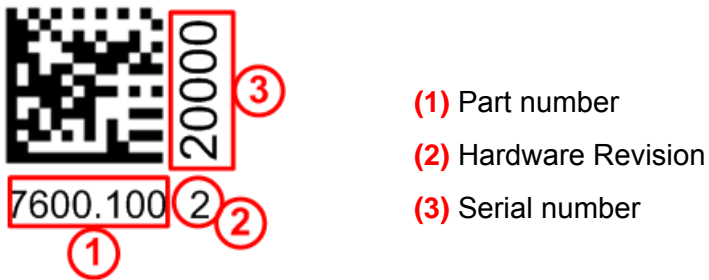


Figure 11: Matrix label

4 Host interface

4.1 Pin assignment

Pin	Signal	Specification	Function	Other shared signals	
1	NRP 10, NRP 52-RE: PE	-	Protected Earth Ground	-	
	NRP 51-RE: n.c.	-	-	-	
2	DPM_D0	I	Dual-Port Memory Data 0	-	
3	DPM_D1	I	Dual-Port Memory Data 1	-	
4	DPM_D2	I	Dual-Port Memory Data 2	-	
5	DPM_D3	I	Dual-Port Memory Data 3	-	
6	DPM_D4	I	Dual-Port Memory Data 4	-	
7	DPM_D5	I	Dual-Port Memory Data 5	-	
8	DPM_D6	I	Dual-Port Memory Data 6	-	
9	DPM_D7	I	Dual-Port Memory Data 7	-	
10	DPM_D8	SPM_MISO	I O6	Dual-Port Memory Data 8	Serial-Host-Memory SPI_MISO
11	DPM_D9	SPM_MOSI	I I	Dual-Port Memory Data 9	Serial-Host-Memory SPI_MOSI
12	DPM_D10	SPM_CS _n	I I	Dual-Port Memory Data 10	Serial-Host-Memory SPI_CS _n
13	DPM_D11	SPM_CLK	I I	Dual-Port Memory Data 11	Serial-Host-Memory SPI_CLK
14	DPM_D12	SPM_DIRQ _n	I O6	Dual-Port Memory Data 12	Serial-Host-Memory DIRQ
15	DPM_D13	SPM_SIRQ _n	I O6	Dual-Port Memory Data 13	Serial-Host-Memory SIRQ
16	DPM_D14	I	Dual-Port Memory Data 14	-	
17	DPM_D15	I	Dual-Port Memory Data 15	-	
18	+3V3		+3.3V Power Supply	-	
19	GND	I	Ground	-	
20	DPM_A0	I	Dual-Port Memory Address 0	-	
21	DPM_A1	I	Dual-Port Memory Address 1	-	
22	DPM_A2	I	Dual-Port Memory Address 2	-	
23	DPM_A3	I	Dual-Port Memory Address 3	-	
24	DPM_A4	I	Dual-Port Memory Address 4	-	
25	DPM_A5	I	Dual-Port Memory Address 5	-	
26	DPM_A6	I	Dual-Port Memory Address 6	-	
27	DPM_A7	I	Dual-Port Memory Address 7	-	
28	DPM_A8	I	Dual-Port Memory Address 8	-	
29	DPM_A9	I	Dual-Port Memory Address 9	-	
30	DPM_A10	I	Dual-Port Memory Address 10	-	
31	DPM_A11	I	Dual-Port Memory Address 11	-	
32	DPM_A12	I	Dual-Port Memory Address 12	-	
33	DPM_A13	I	Dual-Port Memory Address 13	-	
34	DPM_CS _n	I50KU	Dual-Port Memory Chip Select	-	
35	DPM_BHE _n	I50KU	Dual-Port Memory Bus High Enable	-	
36	DPM_RD _n	I50KU	Dual-Port Memory Read	-	

Pin	Signal		Specification		Function	Other shared signals
37	DPM_WRn		I50KU		Dual-Port Memory Write	-
38	DPM_BUSYn		I50KU		Dual-Port Memory Busy	-
39	DPM_DIRQn		I50KU		During start up: Setting of Host Interface Mode (see section Host interface mode on page 23). During runtime: Dual-Port Memory Data Interrupt.	-
40	DPM_SIRQn		NRP 10-XXX: I50KU NRP 51-RE and NRP 52-RE: I50KD and 10 kΩ pull-up (on-board)		During start up: Setting of Host Interface Mode (see section Host interface mode on page 23). During runtime: Dual-Port Memory Synchronization Interrupt.	-
41	DPM_RESEn		I1.5KU		Dual-Port Memory Reset	-
42	UART_RX	SYNC0	I5KU	I5KU / O6	UART Receive Data	Synchronization Signal 0
43	UART_TX	SYNC1	O6	I5KU / O6	UART Transmit Data	Synchronization Signal 1
44	USB-		USB		USB Signal D-	-
45	USB+		USB		USB Signal D+	-
46	S2_1n		I50KU		Switch 2 - D1	-
47	S2_2n		I50KU		Switch 2 - D2	-
48	S2_4n		I50KU		Switch 2 - D4	-
49	S2_8n		I50KU		Switch 2 - D8	-
50	S1_1n		I50KU		Switch 1 - D1	-
51	S1_2n		I50KU		Switch 1 - D2	-
52	S1_4n		I50KU		Switch 1 - D4	-
53	S1_8n		I50KU		Switch 1 - D8	-
54	S0_1		I50KD		Switch 0 - D1	-
	LINK0		O6		Link-LED of Ethernet channel 0	
55	S0_2		I50KD		Switch 0 - D2	-
	ACT0		O6		Activity-LED of Ethernet channel 0	
56	S0_4		I50KD		Switch 0 - D4	-
	LINK1		O6		Link-LED of Ethernet channel 1	
57	S0_8		I50KD		Switch 0 - D8	-
	ACT1		O6		Activity-LED of Ethernet channel 1	
58	GND				Ground	-
59	+3V3		VCC		+3.3V Power Supply	-
60	RDYn	BOOT	O6	I1.5KU	System LED yellow / Ready	System Boot
61	RUNn		O6		System LED green / Run	-
62	COM0_Gn		O6		Communication Status LED 0 green	-
63	COM0_Rn		O6		Communication Status LED 0 red	-
64	COM1_Gn		O6		Communication Status LED 1 green	-
65	COM1_Rn		O6		Communication Status LED 1 red	-
66	GPIO		I50KD / O6		General Purpose In Output	-

Pin	Signal	Specification	Function	Other shared signals
67	-	-	Isolation Gap	-
68	FB1	Field bus specific	Field bus connector pin 1	-
	NRP 51-RE: TXP0	Ethernet specific	Ethernet channel 0 transmit positive	
	NRP 52-RE: RXN0	Ethernet specific	Ethernet channel 0 receive negative	
69	FB2	Field bus specific	Field bus connector pin 2	-
	NRP 51-RE: TXN0	Ethernet specific	Ethernet channel 0 transmit negative	
	NRP 52-RE: RXP0	Ethernet specific	Ethernet channel 0 receive positive	
70	FB3	Field bus specific	Field bus connector pin 3	-
	NRP 51-RE: RXP0	Ethernet specific	Ethernet channel 0 receive positive	
	NRP 52-RE: TXN0	Ethernet specific	Ethernet channel 0 transmit negative	
71	FB4	Field bus specific	Field bus connector pin 4	-
	NRP 51-RE: RXN0	Ethernet specific	Ethernet channel 0 receive negative	
	NRP 52-RE: TXP0	Ethernet specific	Ethernet channel 0 transmit positive	
72	FB5	Field bus specific	Field bus connector pin 5	-
	NRP 51-RE: +3V3PHY	Ethernet specific	+3V3 output for terminating resistors	
	NRP 52-RE: -	Ethernet specific	-	
73	FB6	Field bus specific	Field bus connector pin 6	-
	NRP 51-RE: TXP1	Ethernet specific	Ethernet channel 1 transmit positive	
	NRP 52-RE: RXN1	Ethernet specific	Ethernet channel 1 receive negative	
74	FB7	Field bus specific	Field bus connector pin 7	-
	NRP 51-RE: TXN1	Ethernet specific	Ethernet channel 1 transmit negative	
	NRP 52-RE: RXP1	Ethernet specific	Ethernet channel 1 receive positive	
75	FB8	Field bus specific	Field bus connector pin 8	-
	NRP 51-RE: RXP1	Ethernet specific	Ethernet channel 1 receive positive	
	NRP 52-RE: TXN1	Ethernet specific	Ethernet channel 1 transmit negative	
76	FB9	Field bus specific	Field bus connector pin 9	-
	NRP 51-RE: RXN1	Ethernet specific	Ethernet channel 1 receive negative	
	NRP 52-RE: TXP1	Ethernet specific	Ethernet channel 1 transmit positive	

Table 5: Pin assignment

Gray fields in columns **Signal** and **Specification** indicate that column **Other shared Signals** contains the description of the signal.

The following table lists the meaning of the abbreviations used in the specification column:

Symbol	Meaning
I	Input
I1.5KU	Input with 1.5 kΩ resistor to +3V3
I50KD	Input with 50 kΩ resistor to GND
I50KU	Input with 50 kΩ resistor to +3V3
O6	Output: load of max. 6 mA
Field bus specific	According to the respective field bus specification
Ethernet specific	According to the respective Ethernet specification

Table 6: Symbols of pin assignment

4.2 General signals

4.2.1 Supply voltage

Only a single 3.3 V operation voltage is needed to operate the netRAPID. The voltage must be regulated and can have a tolerance of $\pm 5\%$ (3.15 - 3.45 V) and must be connected twice to the netRAPID chip carrier. The power has to be supplied between pins +3V3 and GND. To avoid EMI problems use bypass capacitors in the power supply path. All other special voltages required on the netRAPID are generated by onboard DC/DC converters.

A voltage supervisor circuit on all netRAPID devices supervises the voltage and the microprocessor. If the voltage decreases below the voltage reset level of typically 2.93 V (2.85 - 3.00 V) the netRAPID is held in reset state. If the voltage exceeds the reset voltage threshold, the netRAPID will begin with the power up sequence. To avoid problems with the power supply we recommend using a voltage of 3.3 V. The operation will thus be in the safe range of the voltage operation area, ensuring that short voltage drops, spikes and noise will not cause any reset conditions.

The maximum power consumption depends on the netRAPID type. For power consumption values see section *SPM Interface NRPEB 51-RE (X300)* on page 63.

4.2.2 PE and ground signal

For NRP 10-CCS, NRP 10-DPS and NRP 52-RE



Important:

On the host system, always use a capacitor of 1 nF/2000 V between PE (of netRAPID) and GND (of netRAPID). If you do not use this capacitor in your design this results in a worse EMC behavior.

For NRP 51-RE

Pin 1 (PE) is unconnected and a capacitor is not needed.

4.2.3 Reset signal

It is possible to reset the netRAPID by the global power-on reset signal `DPM_RESETh`. As long as the signal `DPM_RESETh` has high level, the netRAPID stays in operating mode.

The netRAPID is in reset mode when the signal `DPM_RESETh` has a static low level. To reset the netRAPID the `DPM_RESETh` signal must be low for more than 10 μ s. Afterwards, the netRAPID starts the initialization and program execution. This power up time is different for each netRAPID and loaded firmware.



Important:

During reset all signals of the dual-port memory are configured as inputs! The output level could be floating.

If the host system needs a stable level, a pull-up or pull-down resistor is required on the host system.

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74, *Figure 33: Schematic NRPEB 52-RE (Part 1)* on page 80 or see *Figure 29: Schematic NRPEB 51-RE (Part 1)* on page 76.

Recommendation: Always add a push button to your host system connected to the netRAPID device to reset the netRAPID device. This reset button together with the mandatory push button (or switch or an equivalent device) to activate the serial boot mode is important for your production, because the serial boot mode is needed to load the Second Stage Boot Loader into the netRAPID device.

4.2.4 Boot signal and boot options

Mandatory: Always add a push button or switch (or an equivalent device) to your host system connected to the netRAPID device to activate the serial boot mode of the ROM loader. The serial boot mode is necessary for your production to load the Second Stage Boot Loader into the netRAPID device or later for support to be able to update the Second Stage Boot Loader. If you do not implement a push button or switch (or an equivalent device) to your host system, you will not be able to load or update the Second Stage Boot Loader! With NRP 52 devices without a Second Stage Boot Loader activate the Ethernet boot mode by default which is not supported.

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74, *Figure 33: Schematic NRPEB 52-RE (Part 1)* on page 80 or see *Figure 29: Schematic NRPEB 51-RE (Part 1)* on page 76.

Note: If you want to make use of the other boot options that the netRAPID offers, you need to implement two DIP switches or an equivalent device for switching two signals (RUN and RDY).

Note: To serial boot mode requires an USB interface or a serial (UART) interface.

Activating the boot mode

The boot signal is located at pin 60 (RDY). After a reset it is an input signal and active low. To activate the boot mode, pin 60 has to be connected via 390 Ω to GND (low signal) after a reset.

Note: The signal level during the reset and shortly afterwards must be low in order to force the netRAPID into the boot mode.

4.2.5 Host interface mode

netRAPIDs support two host interface modes

- parallel dual-port memory and
- serial dual-port memory (SPI).

The host interface mode is evaluated by the Second Stage Boot Loader during boot. The Second Stage Boot Loader uses this setting to initialize the selected dual-port memory mode in the host interface.

Activating the parallel dual-port memory mode

- A high signal at `DPM_DIRQn` (pin 39) activates the dual-port memory mode (the input is open).
- The data width of the dual-port memory can be set to 8 or 16 bit. The data width is set at `DPM_SIRQn` (pin 40) during the start-up phase.
 - A high signal at `DPM_SIRQn` (the input is open) sets the data width of 8 bit.
 - A low signal at `DPM_SIRQn` (via a 2.2 k Ω pull-down resistor) sets the data width of 16 bit.

Activating the serial dual-port memory mode (SPI)

A low signal at `DPM_DIRQn` activates the SPI mode (via a 2.2 k Ω pull-down resistor).

netRAPID internal pull-up and pull-down resistors

Pin	Signal	netX 10 on NRP 10	netX 51 on NRP 51 or netX 52 on NRP 52
39	<code>DPM_DIRQn</code>	50 k Ω pull-up (internal)	50 k Ω pull-up (internal)
40	<code>DPM_SIRQn</code>	50 k Ω pull-up (internal)	50 k Ω pull-down (internal) and 10 k Ω (on-board)

Table 7: netRAPID internal pull-up and pull-down resistors



Important: Never drive the host interface mode signal (`DPM_DIRQn` pin 39). Instead, operation with pull-down and pull-up resistors is recommended.

4.3 Parallel dual-port memory

The communication for all input and output data and control commands between the netRAPID and the host system are exchanged over the dual port memory.

From host system side, the dual-port memory looks like static RAM. The netRAPID always provides addressing capabilities for 16 KByte dual port memory. Only a few signals are used to control the access to the dual port memory.

These data lines can drive 6 mA at maximum.

To avoid data loss by simultaneous access at the same memory cell, it is necessary to use the `BUSYn` signal.

Please refer to the special documents for the basic description of the data model and communication methods with devices based on the netX.

4.3.1 Address bus and data bus

These signal lines contain the address bus lines A0 up to A13 and data bus lines D0 up to D15 of the dual-port memory. The address and data lines are non-multiplexed. The dual-port memory of the netRAPID has a size of 16 KB. NRP 10 devices only use the lowest 8 KB of the dual-port memory.

Unused address lines may be equipped with a pull-down resistor of 560 Ω.

The following table explains the available possibilities:

netRAPID	Host address space	Connect	Pull-down to address line
NRP 10	8 KB	A0 ... A12	A13
NRP 51, NRP 52	16 KB	A0 ... A13	none

Table 8: Possibilities for usage of dual-port memory

netRAPID support 8 or 16-bit mode. Section *Host interface mode* on page 23 describes how to activate the 8 or 16-bit mode.

In case of a 16-bit system you have to generate the `DPM_BHEn` (pin 35) and `DPM_A0` (pin 20) signal according to the following table.

DPM_BHE _n	DPM_A0	Function
0	0	word access
0	1	access high byte
1	0	access low byte
1	1	no access

Table 9: Function table of the 16-bit decode logic

4.3.2 Dual-port memory control lines

Integration of the netRAPID is done by mapping the memory space of the dual port memory into the address range of the host system.

The access to the dual-port memory is handled over the control lines `DPM_WRn` (pin 37, write), `DPM_RDn` (pin 36, read) and `DPM_CSn` (pin 34, Chip select) and could be like standard static RAM.

All signals are low active.

4.3.3 Interrupt line to the host system

The signal `DPM_DIRQn` (located at pin 39, also used as mode discrimination signal) can be used to generate an interrupt to the host system when the netX processor of the netRAPID writes into the specific handshake cells of the dual-port memory. These cells are used for synchronization of the netRAPID and the host system and have handshake bits. The interrupt will be cleared if the host reads the handshake cell that was written from the netX of the netRAPID.



Important: In interrupt mode, when an 8-bit host performs a read access to any of the 16-bit wide handshake registers, the netX releases the interrupt as soon as the high byte or the low byte was read. The read order (high byte first or low byte first) is irrelevant. An 8-bit host shall use polling mode instead of interrupt mode!



Important: Never drive the signal `DPM_DIRQn` (pin 39). Instead, operation with pull-down and pull-up resistors is recommended.

4.3.4 Busy line to the host system

The signal `DPM_BUSYn` is used to insert wait states into a current access from host system to a netRAPID. When the signal is active the host must wait for the current transfer.

Also see the timing diagram in section *Timing diagram dual-port memory interface* on page 26.

4.3.5 Timing diagram dual-port memory interface

The following diagram shows the timing for dual-port memory read access.

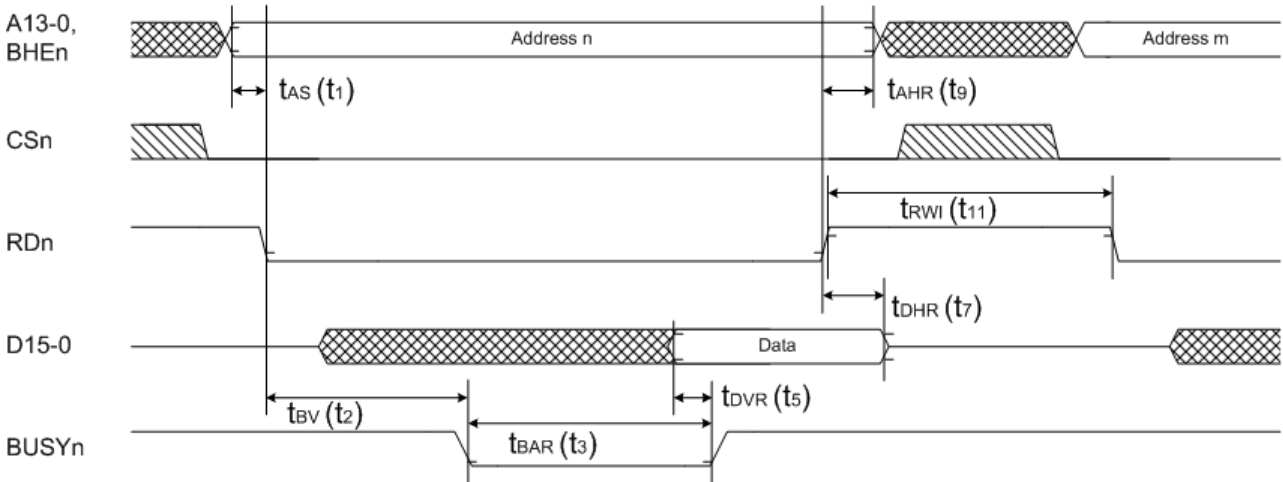


Figure 12: Timing diagram for read access

The following diagram shows the timing for dual-port memory write access.

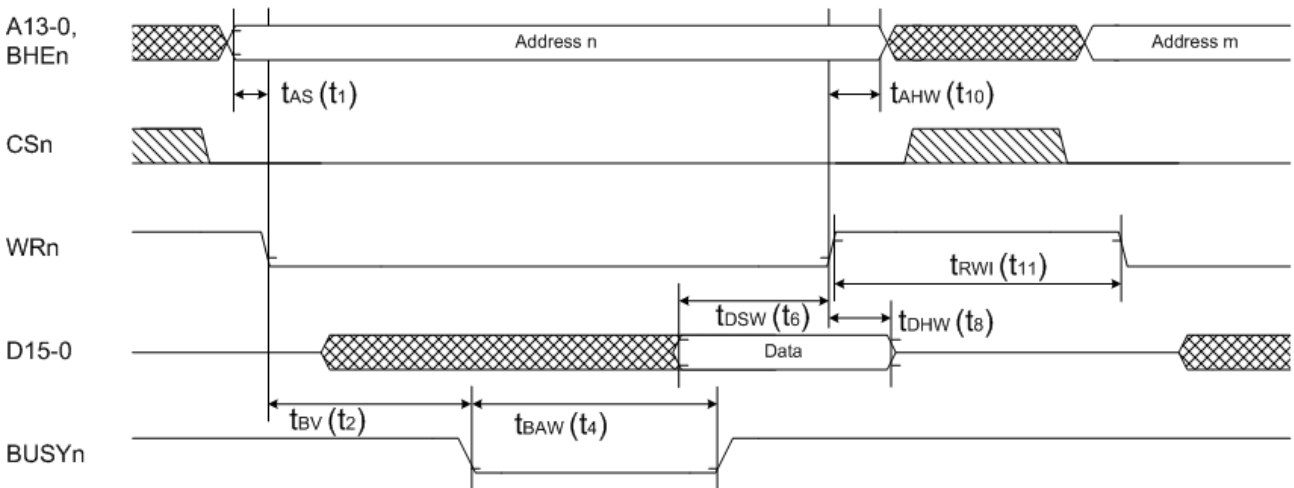


Figure 13: Timing diagram for write access

Description and values are on the next page.

The following table gives the values for the timing parameters for netRAPID devices. For exchangeability of netRAPID NRP 52 with netRAPID NRP 10 devices and visa versa use the values of column **Common** of Table 10.

Symbol		Description	netRAPID 10 netX 10	netRAPID 51 netX 51	netRAPID 52 netX 52	Common
t ₁	t _{AS min.}	Minimum address setup time	0 ns	0 ns	0 ns	2 ns
t ₂	t _{BV max.}	Maximum time from cycle start until BUSYn signal is valid	5.7 ns	5.7 ns	5.7 ns	40 ns
t ₃	t _{BAR typ.}	Typical BUSY active time (read access)	-	-	-	-
	t _{BAR max.}	See important note 1	68 ns	68 ns	68 ns	-
t ₄	t _{BAW min.}	Minimum BUSY active time (write access)	0 ns	0 ns	0 ns	0 ns
	t _{BAW max.}	See important note 1	68 ns	68 ns	68 ns	-
t ₅	t _{DVR min.}	Minimum time between valid data bus signals and rising edge of BUSYn signal	7.8 ns	7.8 ns	7.8 ns	5 ns
t ₆	t _{DSW min.}	Minimum setup time for write data	10.8 ns	12.8 ns	12.8 ns	25 ns
t ₇	t _{DHR min.}	Minimum read data hold time	2.1 ns	2.1 ns	2.1 ns	0 ns
t ₈	t _{DHW min.}	Minimum hold time for write data	0.8 ns	2.8 ns	2.8 ns	2.8 ns
t ₉	t _{AHR min.}	Minimum address hold time	0 ns	0 ns	0 ns	0 ns
t ₁₀	t _{AHW min.}	Minimum address hold time	0.9 ns	2.9 ns	2.9 ns	2.9 ns
t ₁₁	t _{RWI}	Minimum inactive time for RDn or WRn	10.5 ns	12.5 ns	12.5 ns	12.5 ns

Table 10: Symbols for netRAPID timing diagram for read and write access

Important note 1: Avoid dual-port memory access errors

It is mandatory that the host CPU always uses the BUSYn signal, otherwise this results in wrong data read from the dual-port memory or dual-port memory write accesses are ignored.

- For maximum performance, the BUSYn signal must always be evaluated by the host CPU.

Note 2: The value for t_{BAR typ.} (t_{3 typ.}) depends on the used firmware/application on the netX.

Note 3: DPM_BHEn (pin 35) only used for 16 bit interface.

4.4 Serial dual-port memory mode

The netRAPIDs offer a serial dual-port memory interface, which is a SPI Slave interface. The supported mode is clock idle state high with sampling on the trailing clock edge (SPI mode 3).

The Serial Peripheral Interface (SPI) is a bus system for the synchronous serial communication of digital electronic circuits allowing versatile applications. It is based on the master-slave-principle.

The following figure shows the general connection of the serial dual-port memory to any SPI capable host CPU.

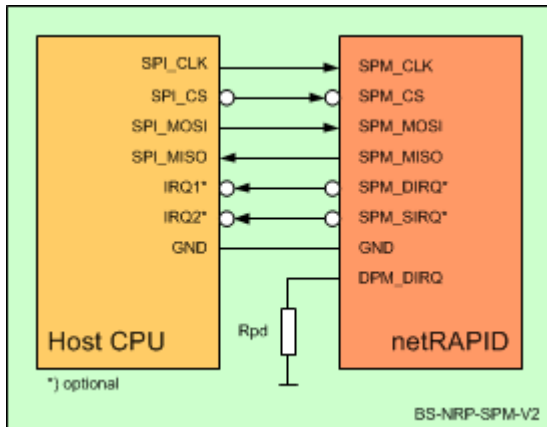


Figure 14: Serial dual-port memory interface

Table 5 on page 20 documents the pin assignment for netRAPID.

Activating the serial dual-port memory mode

A pull-down resistor (R_{pd}) is required to activate the serial dual-port memory mode. For more details, see section *Host interface mode* on page 23.

Timing diagram serial dual-port memory interface

To access the serial dual-port memory,

- see timing diagram in section *Serial IO Mode Timing* in the document *Technical Data Reference Guide, netX 10* (reference [2]),
- see timing diagram in section *Serial IO Mode Timing* in the document *Technical Data Reference Guide, netX 51/52* (reference [3]).

Software implementation and protocol

A protocol contains an address, a function identifier (read/write), a length information and data to access to the dual-port memory.

For information about the software implementation and the protocol see section *Host Software Implementation* and section *Serial DPM Protocol Description* in the document *Serial Dual-Port Memory Interface*, see reference [1].

Important: The host application has to do **two** read commands to initialize the serial dual-port memory communication (SPI). Any address can be used.

5 Diagnostic interface

The diagnostic interface can be used for

- configuration download,
- diagnostic purposes and
- firmware update (firmware update at netRAPID NRP 10 only)

It is **mandatory** to add a diagnostic interface to the host system.

This interface is needed during the production process to load the Second Stage Boot Loader and firmware into the netRAPID device.

5.1 USB interface

The USB interface is needed during production to load the Second Stage Boot Loader and the firmware into the netRAPID device. The USB interface is handled by the ROM loader in this case.

Once the Second Stage Boot Loader is running, the Second Stage Boot Loader handles the USB interface.

Once the firmware is running, the firmware handles the USB interface.

Note: The standard firmware activates the USB interface by default.

The following pins of the netRAPID relate to the Universal Serial Bus (USB) interface.

Pin	Name
44	USB-
45	USB+

Table 11: Pin assignment of USB interface

The USB signals have LVTTTL level (3.3 V).

Note: USB is used for diagnostic and for production purposes.

Note: The external USB power supply line is not used by the netRAPID.

The USB signals have to be protected with 22 Ω and transient diode. The circuit for the host system is shown in chapter *Schematics* which is on page 74 (NRPEB 10-CCS and NRPEB 10-DPS) or page 80 (NRPEB 52-RE).

5.2 Serial interface – UART

The pins of the UART interface are shared with the pins for the SYNC interface.

Note: The standard firmware activates the SYNC interface and deactivates the UART by default.

The following pins of the netRAPID relate to the serial interface (UART). The table provides the signal names:

Pin	Name	Shared with
42	UART_RX	SYNC0
43	UART_TX	SYNC1

Table 12: Pin assignment to serial interface (UART)

The signals UART_RX and UART_TX have LVTTTL level. They allow setting up an interface for diagnostic purposes.

6 Device type specific interfaces

6.1 NRP 10-CCS

6.1.1 Connections overview

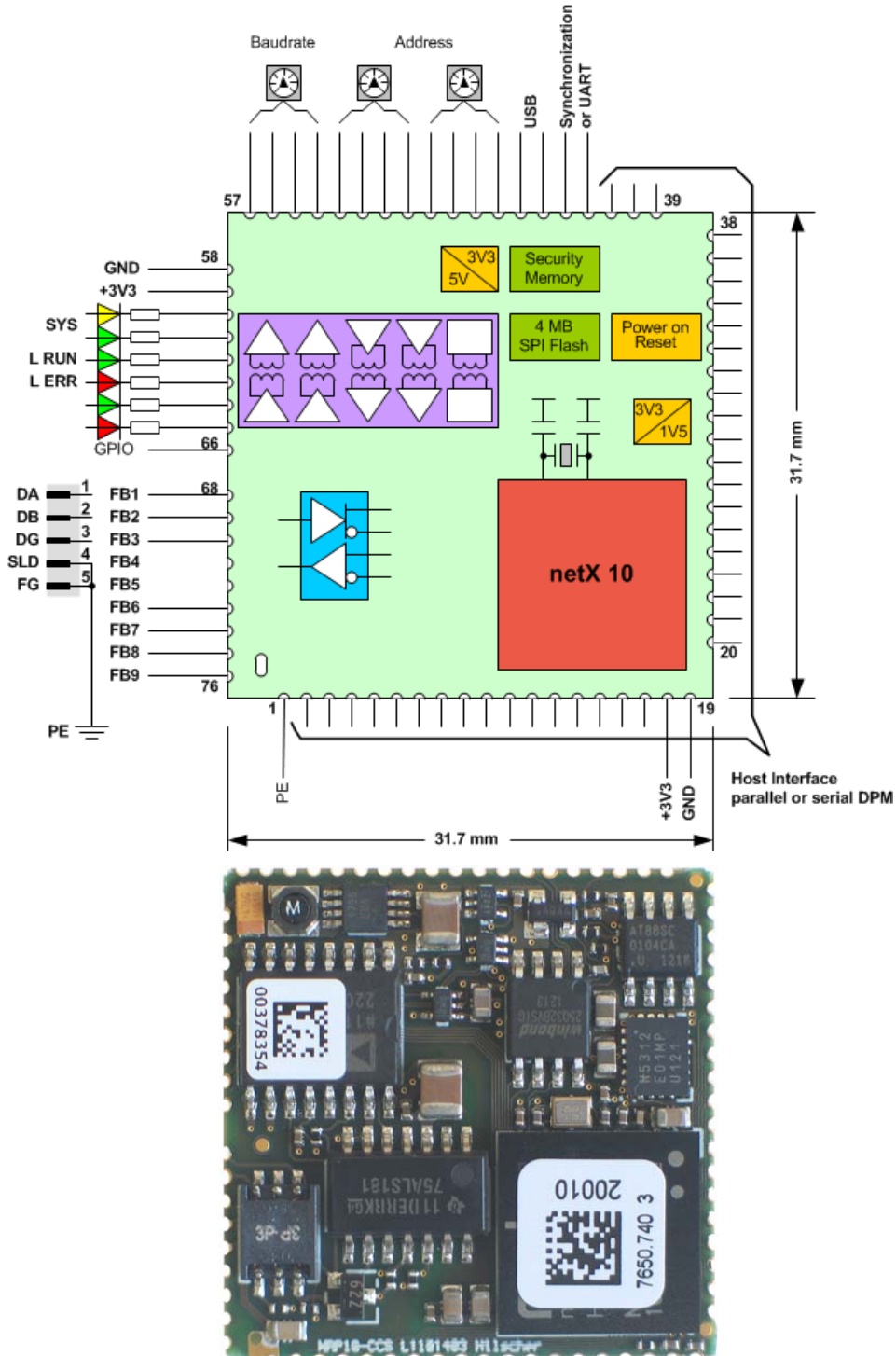


Figure 15: NRP 10-CCS connections overview

6.1.2 CC-Link interface

The pin assignment for CC-Link:

Pin	Signal	CC-Link Signal
68	FB1	DA
69	FB2	DB
70	FB3	DG
71	FB4	Do not connect
72	FB5	Do not connect
73	FB6	not connected
74	FB7	not connected
75	FB8	not connected
76	FB9	not connected

Table 13: Pin assignment CC-Link interface of NRP 10-CCS

It is also strongly recommended to keep the length for the signal lines below 30 mm and to take EMC aspects into account.

Do not connect pin FB4 to the 5-pin COMBICON connector. Do not connect pin FB5 to the 5-pin COMBICON connector. Connect SLD and FG of the CC-Link COMBICON connector to PE.

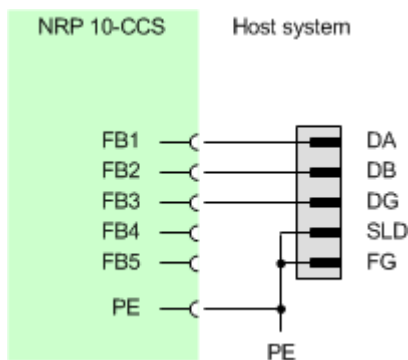


Figure 16: Connecting the CC-Link COMBICON to NRP 10-CCS

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

6.1.3 LEDs

Pin	Signal	No.	Function
60	RDYn	V11	System status LED (SYS) yellow
61	RUNn	V11	System status LED (SYS) green
62	COM0_Gn	V12	Communication status LED (COM0) green CC-Link: L RUN
63	COM0_Rn	V12	Communication status LED (COM0) red CC-Link: L ERR
64	COM1_Gn	V13	Communication status LED (COM1) green CC-Link: not used
65	COM1_Rn	V13	Communication status LED (COM1) red CC-Link: not used
66	GPIO	V1	yellow (560 Ω to +3V3)
66	GPIO	V1	green (560 Ω to GND)

Table 14: Pin assignment LEDs (NRP 10-CCS)

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

6.1.4 Address and baud rate switches

The CC-Link Slave firmware reads the position of three switches to configure the CC-Link station address and the baud rate.

Pin	Signal	Function	
46	S2_1n	Switch 2 – D1	Address *10
47	S2_2n	Switch 2 – D2	
48	S2_4n	Switch 2 – D4	
49	S2_8n	Switch 2 – D8	
50	S1_1n	Switch 1 – D1	Address *1
51	S1_2n	Switch 1 – D2	
52	S1_4n	Switch 1 – D4	
53	S1_8n	Switch 1 – D8	
54	S0_1	Switch 0 – D1	Baud rate
55	S0_2	Switch 0 – D2	
56	S0_4	Switch 0 – D4	
57	S0_8	Switch 0 – D8	

Table 15: Pin assignment address switch and baud rate switch (NRP 10-CCS)

The switches are BCD coded with 10 positions. Example for a switch: COPAL Typ: SA-7111TA, see <http://www.copal-electronics.com/>

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

The meaning of the switches is explained in section *Address switches (S1, S2) and baud rate switch (S0)* on page 46.

6.1.5 SYNC

There are no signals on SYNC0 and SYNC1 because the CC-Link Slave firmware does not generate SYNC signals.

6.2 NRP 10-DPS

6.2.1 Connections overview

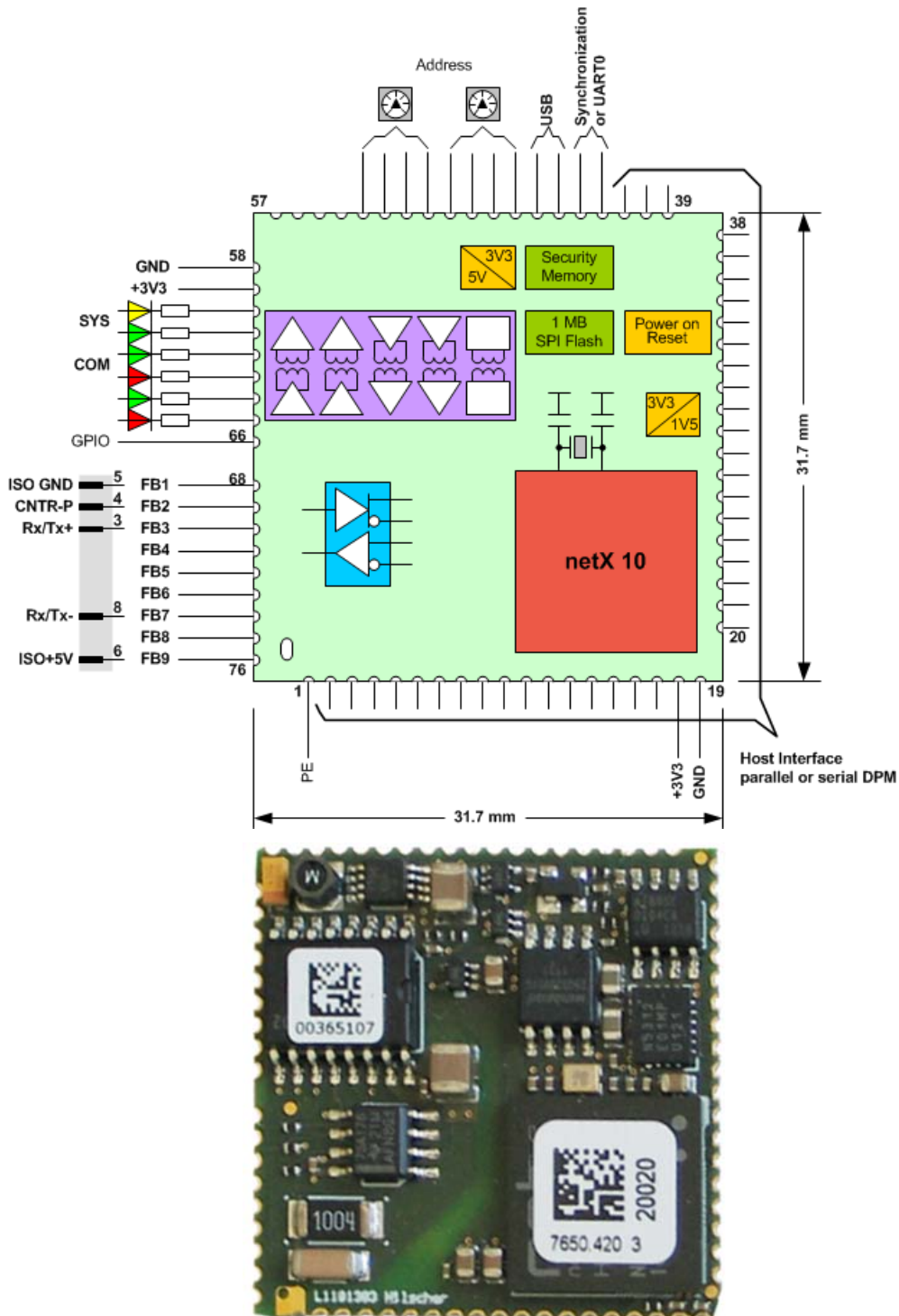


Figure 17: NRP 10-DPS connections overview

6.2.2 PROFIBUS DP interface

The pin assignment for PROFIBUS DP:

Pin	Signal	PROFIBUS DP Signal
68	FB1	ISO GND
69	FB2	CNTR-P
70	FB3	Rx/Tx+
71	FB4	not connected
72	FB5	not connected
73	FB6	not connected
74	FB7	Rx/Tx-
75	FB8	not connected
76	FB9	VP

Table 16: Pin assignment PROFIBUS DP interface of NRP 10-DPS

It is also strongly recommended to keep the length for the signal lines below 30 mm and to take EMC aspects into account.

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

6.2.3 LEDs

Pin	Signal	No.	Function
60	RDYn	V11	System status LED (SYS) yellow
61	RUNn	V11	System status LED (SYS) green
62	COM0_Gn	V12	Communication Status LED (COM0) green PROFIBUS DP COM
63	COM0_Rn	V12	Communication Status LED (COM0) red PROFIBUS DP COM
64	COM1_Gn	V13	Communication Status LED (COM1) green PROFIBUS DP not used
65	COM1_Rn	V13	Communication Status LED (COM1) red PROFIBUS DP not used
66	GPIO	V1	yellow (560 Ω to +3V3)
66	GPIO	V1	green (560 Ω to GND)

Table 17: Pin assignment LEDs (NRP 10-DPS)

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

6.2.4 Switches

The PROFIBUS DP Slave firmware reads the position of two address switches to configure the PROFIBUS station address.

Pin	Signal	Function	
46	S2_1n	Switch 2 – D1	Address *10
47	S2_2n	Switch 2 – D2	
48	S2_4n	Switch 2 – D4	
49	S2_8n	Switch 2 – D8	
50	S1_1n	Switch 1 – D1	Address *1
51	S1_2n	Switch 1 – D2	
52	S1_4n	Switch 1 – D4	
53	S1_8n	Switch 1 – D8	
54	S0_1	Switch 0 – D1	not used
55	S0_2	Switch 0 – D2	
56	S0_4	Switch 0 – D4	
57	S0_8	Switch 0 – D8	

Table 18: Pin assignment address switch (NRP 10-DPS)

The switches are BCD coded with 10 positions. Example of a switch: COPAL Type: SA-7111TA, see <http://www.copal-electronics.com/>

For details about the circuit for the host system see *Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)* on page 74.

The meaning of the switches is explained in section *Address switches (S1, S2) for PROFIBUS DP* on page 47.

6.2.5 SYNC

There are no signals on SYNC0 and SYNC1 because the PROFIBUS DP Slave firmware does not generate SYNC signals.

6.3 NRP 51-RE

6.3.1 Connections overview

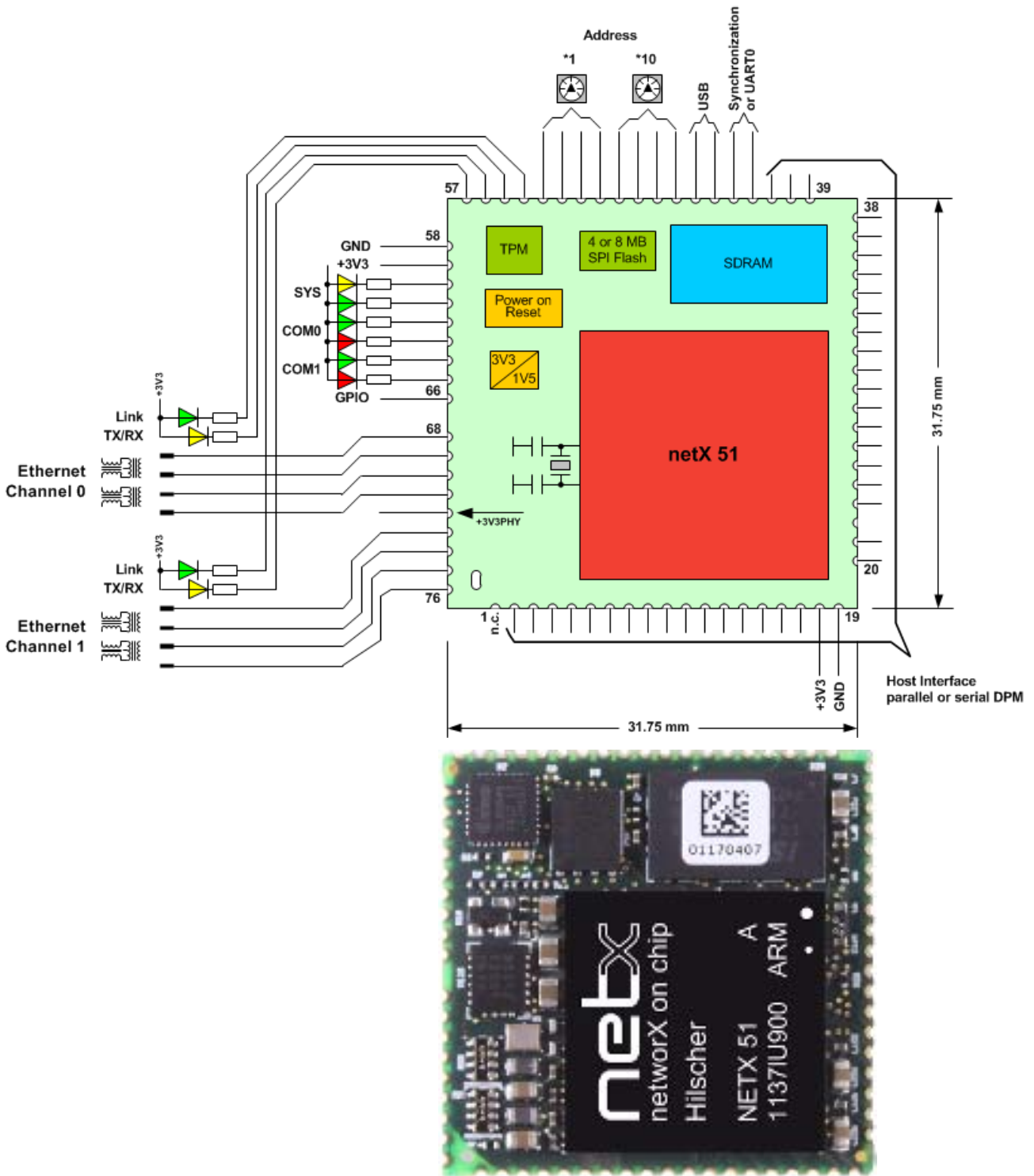


Figure 18: NRP 51-RE / NRP 51-REV8T connections overview

NRP 51-RE has 4 MByte Flash and no TPM chip.

NRP 51-REV8T has 8 MByte Flash and a TPM chip.

6.3.2 Ethernet interface

The pin assignment for Ethernet:

Pin	Signal	Ethernet Signal
68	FB1	TXP0
69	FB2	TXN0
70	FB3	RXP0
71	FB4	RXN0
72	FB5	+3V3PHY (out)
73	FB6	TXP1
74	FB7	TXN1
75	FB8	RXP1
76	FB9	RXN1

Table 19: Pin assignment Ethernet interface of NRP 51-RE

It is also strongly recommended to keep the length for the signal lines below 30 mm and to take EMC aspects into account. Make sure that the complete design fulfills the requirements of specification IEEE 802.3.

On the host system, magnetics have to be used. For details about the circuit for the host system, see Figure 30 on page 77.

6.3.3 LEDs

Pin	Signal	No. NRP 51-RE	No. NRP 52-RE	Function
54	LINK0	X203-C		Link-LED of Ethernet channel 0
55	ACT0	X203-C		Activity-LED of Ethernet channel 0
56	LINK1	X203-D		Link-LED of Ethernet channel 1
57	ACT1	X203-D		Activity-LED of Ethernet channel 1
60	RDYn	P200	V11	System status LED (SYS) yellow
61	RUNn	P200	V11	System status LED (SYS) green
62	COM0_Gn	P201	V12	Communication Status LED (COM0) green
63	COM0_Rn	P201	V12	Communication Status LED (COM0) red
64	COM1_Gn	P202	V13	Communication Status LED (COM1) green
65	COM1_Rn	P202	V13	Communication Status LED (COM1) red
66	GPIO	P203	V1	yellow (560 Ω to +3.3 V)
66	GPIO	P203	V1	green (560 Ω to GND)

Table 20: Pin assignment LEDs (NRP 51-RE, NRP 52-RE)

Use two red/green LEDs, which cover all Real-Time Ethernet protocols.

For details about the circuit for the host system, see

- Figure 29 on page 76 (NRPEB 51-RE) or
- Figure 33 on page 80 (NRPEB 52-RE), respectively.

6.3.4 Switches

Note: Address switches are for future use, as the Ethernet firmware does not read the positions of the switches.

Pin	Signal	Function	
46	S2_1n	Switch 2 – D1	Address *10
47	S2_2n	Switch 2 – D2	
48	S2_4n	Switch 2 – D4	
49	S2_8n	Switch 2 – D8	
50	S1_1n	Switch 1 – D1	Address *1
51	S1_2n	Switch 1 – D2	
52	S1_4n	Switch 1 – D4	
53	S1_8n	Switch 1 – D8	
54	S0_1	Switch 0 – D1	not used
55	S0_2	Switch 0 – D2	
56	S0_4	Switch 0 – D4	
57	S0_8	Switch 0 – D8	

Table 21: Pin assignment address switch (NRP 52-RE)

The switches are BCD coded with 10 positions. Example for a switch: COPAL Typ: SA-7111TA, see <http://www.copal-electronics.com/>

For details about the circuit for the host system, see schematics of the Evaluation Board in section *NRPEB 51-RE* on page 76 or *NRPEB 52-RE* on page 80, respectively.

6.3.5 SYNC

The pins of the SYNC interface are shared with the pins for the UART interface.

Note: By default the SYNC interface is activated and UART is deactivated in the standard firmware.

Pin	Name	Shared with
42	SYNC0	UART_RX
43	SYNC1	UART_TX

Table 22: Pin assignment to SYNC interface

The SYNC Signal has LVTTTL level. A maximum load of 6 mA may not be exceeded.



NOTICE

Possible Destruction of the Device due to high current!

Make sure that outputs never drive against each other. Two outputs that drive against each other cause a too high current and result in device damage.

This situation can happen for example if the host system has an output signal connected to SYNC0 and a firmware is loaded that uses SYNC0 as output too.

It is also strongly recommended to keep the cable length for the SYNC signals below 50 mm and to take EMC aspects into account. In general, both SYNC signal lines can be used as input or output.

The following table shows the meaning of the SYNC signals for the real-time Ethernet protocols currently offering SYNC signal support.

Protocol	Signal SYNC0 Input/Output	Signal SYNC1 Input/Output	Since Firmware Version	Remarks
EtherCAT Slave	SYNC 0 Output	SYNC 1 Output	-	Configurable
PROFINET IO- Device	-	-	-	-
Sercos Slave	CON_CLK Output	DIV_CLK Output	3.0.10.0	Configurable

Table 23: Meaning of the SYNC signals

6.4 NRP 52-RE

6.4.1 Connections overview

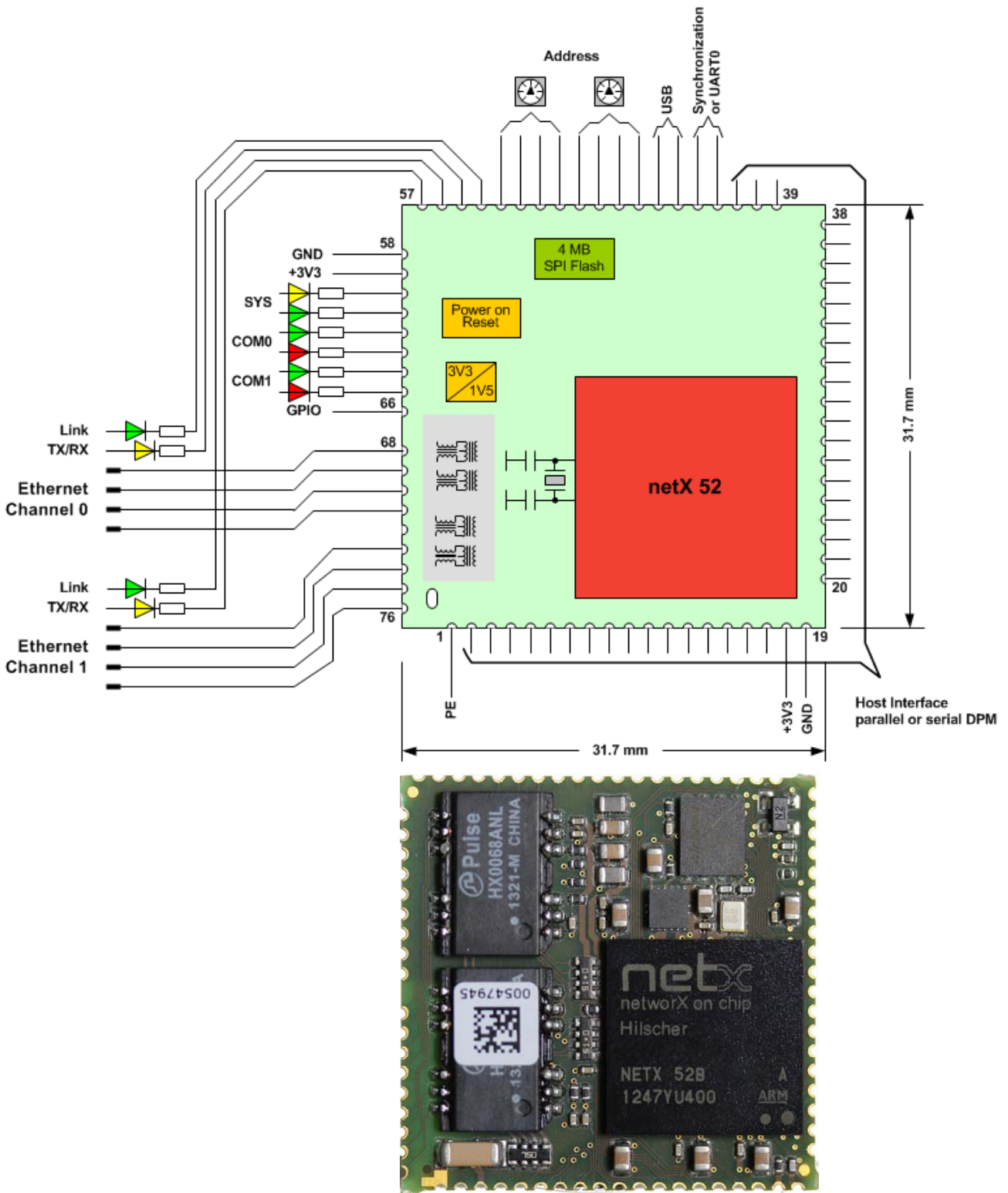


Figure 19: NRP 52-RE connections overview

6.4.2 Ethernet interface

The pin assignment for Ethernet:

Pin	Signal	Ethernet Signal
68	FB1	RXN0
69	FB2	RXP0
70	FB3	TXN0
71	FB4	TXP0
72	FB5	not connected
73	FB6	RXN1
74	FB7	RXP1
75	FB8	TXN1
76	FB9	TXP1

Table 24: Pin assignment Ethernet interface of NRP 52-RE

It is also strongly recommended to keep the length for the signal lines below 30 mm and to take EMC aspects into account. Make sure that the complete design fulfills the requirements of specification IEEE 802.3.

For details about the circuit for the host system, see Figure 33 on page 80.

6.4.3 LEDs

See section *LEDs* on page 39.

6.4.4 Switches

See section *Switches* on page 40.

6.4.5 SYNC

See section *SYNC* on page 41.

7 Evaluation Boards

7.1 Evaluation Board NRPEB 10-CCS and NRPEB 10-DPS

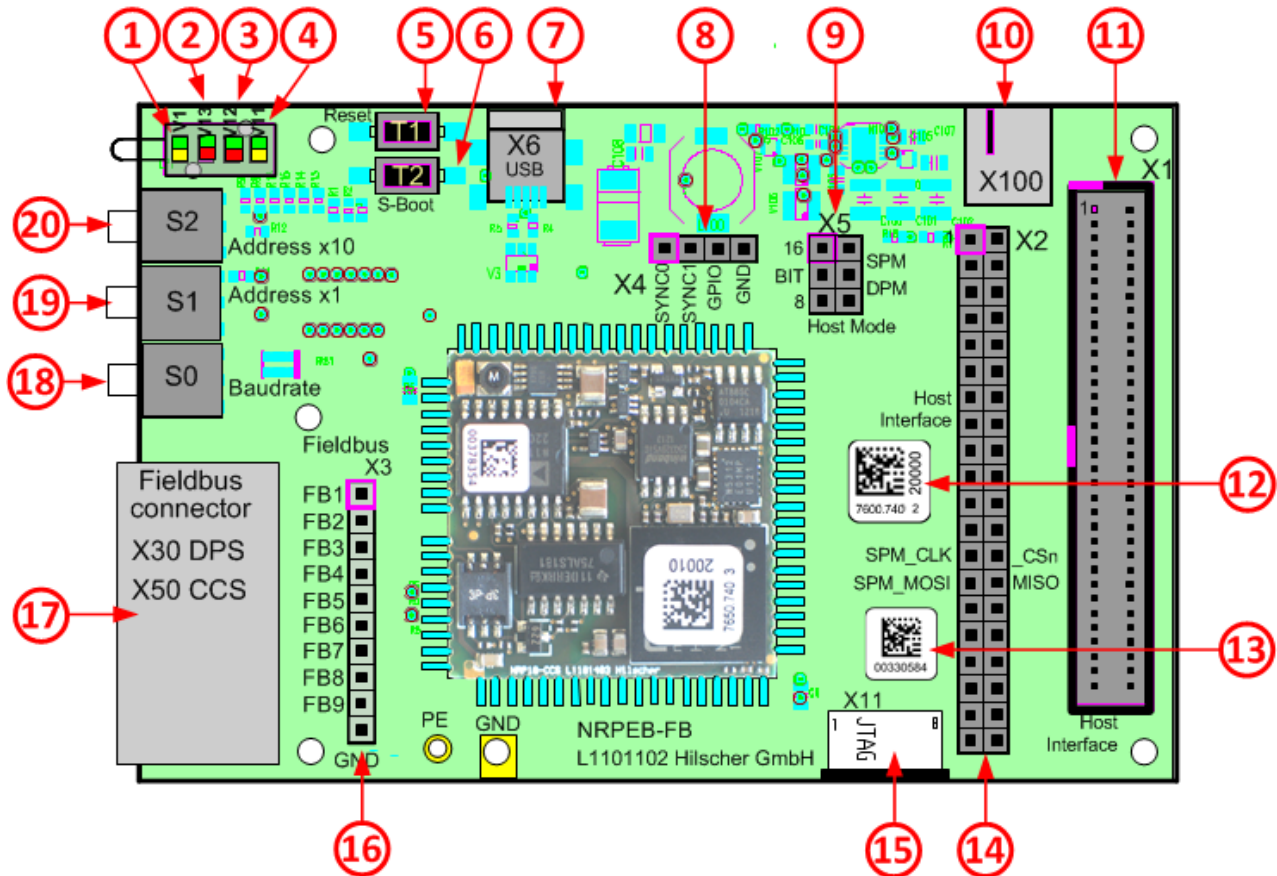


Figure 20: Evaluation Board NRPEB 10-CCS and NRPEB 10-DPS

No. in figure	Name	Description	Page
(1)	V1	LED GPIO	-
(2)	V13	LED COM1	-
(3)	V12	LED COM0	-
(4)	V11	LED SYS	-
(5)	T1	Reset button	53
(6)	T2	Button for serial boot mode	53
(7)	X6	USB interface (Mini-USB)	60
(8)	X4	SYNC and GPIO measuring points	57
(9)	X5	Host interface mode setting	58
(10)	X100	Connector for power supply	62
(11)	X1	Host interface	54
(12)	-	Matrix label (part number, hardware revision and serial number)	17
(13)	-	Label with production number	-
(14)	X2	Host interface measuring points	56
(15)	X11	JTAG interface, foil connector (for Hilscher development and production only)	61
(16)	X3	Field bus interface measuring points	45
(17)	X30	PROFIBUS DP connector (NRPEB 10-DPS)	45

No. in figure	Name	Description	Page
	X50	CC-Link connector (NRPEB 10-CCS)	46
(18)	S0	Baud rate switch CC-Link baud rate (implemented on NRPEB 10-CCS only)	46
(19)	S1	Address switch Station address * 1	46 (CC-Link) 47 (PROFIBUS)
(20)	S2	Address switch Station address * 10	

Table 25: Positions of NRPEB 10-CCS and NRPEB 10-DPS

7.1.1 Fieldbus measuring points (X3)

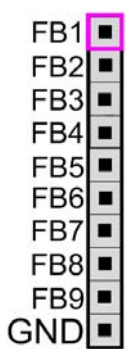
X3	Pin	Signal	Pin	Pin assignment
	1	FB1	68	Pin assignment for CC-Link see section <i>CC-Link interface</i> on page 32.
	2	FB2	69	
	3	FB3	70	Pin assignment for PROFIBUS see section <i>PROFIBUS DP interface</i> on page 36.
	4	FB4	71	
	5	FB5	72	
	6	FB6	73	
	7	FB7	74	
	8	FB8	75	
	9	FB9	76	
	10	GND		

Table 26: Pin assignment fieldbus interface X3

7.1.2 PROFIBUS DP (X30)

PROFIBUS DP pin assignment

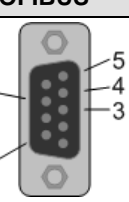
PROFIBUS	Pin	Signal	Description
 <p>9-pole sub-D socket, female</p>	3	FB3 / Rx/Tx +	Receive- / Transmit data positive
	4	FB2 / CNTR-P	Control signal for repeater (direction control)
	5	FB1 / ISO GND	Data ground
	6	FB9 / VP	Power supply positive 5V for terminating resistor only.
	8	FB7 / Rx/Tx -	Receive- / Transmit data negative
	Shield	PE	Metal shell on PE

Table 27: PROFIBUS RS-485 pin assignment

Position (17) in Figure 20 on page 44.

7.1.3 CC-Link (X50)

CC-Link pin assignment

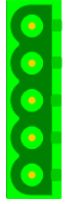
CC-Link	Pin	Signal	Description
 COMBICON male connector	1	FB1 / DA	Data positive
	2	FB2 / DB	Data negative
	3	FB3 / DG	Data ground, to ISO_GND, 3.3 nF against PE
	4	FB4 / SLD	Shield, Pin 4 and Pin 5 are connected internally
	5	FB5 / FG	Fieldground, Pin 4 and Pin 5 are connected internally and are on PE

Table 28: CC-Link pin assignment

Position (17) in Figure 20 on page 44.

7.1.4 Address switches (S1, S2) and baud rate switch (S0) for CC-Link

The following table shows the meaning of the switches.



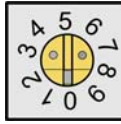
CC-Link Slave	Station address		Baud rate
	S2, position (20) in Figure 20 on page 44.	S1, position (19) in Figure 20 on page 44.	S0, position (18) in Figure 20 on page 44.
			
Station address =	Value * 10	+ Value * 1	
Value range for Station address: 1 ... 64	0 ... 6 = valid address 7, 8, 9 = invalid address, error	0, 1, ..., 8, 9 = valid address	0 = 156 kBaud 1 = 625 kBaud 2 = 2,5 MBaud 3 = 5 MBaud 4 = 10 MBaud 5 ... 9 = Invalid, error

Table 29: Description of the address and baud rate switch

Example: For station address 12 set S2 to 1 and S1 to 2. For baud rate 156 kBaud set S0 to 0.

Depending on the configuration parameter 'Number of stations' (firmware parameter), the value range for station address is:

Number of stations	Value range for station address
1	1 ... 64
2	1 ... 63
3	1 ... 62
4	1 ... 61

Table 30: Value range for station address depending on number of stations

7.1.5 Address switches (S1, S2) for PROFIBUS DP

The following table shows the meaning of the switches.



PROFIBUS DP Slave	Station address	
	S2, position (20) in Figure 20 on page 44.	S1, position (19) in Figure 20 on page 44.
		
Station address =	Value * 10	+ Value * 1
Value range for Station address: 0 ... 99	0, 1, ..., 8, 9 = valid address	0, 1, ..., 8, 9 = valid address

Table 31: Meaning of the address switch (PROFIBUS DP)

Example: For station address 12 set S2 to 1 and S1 to 2.

7.2 Evaluation Board NRPEB 51-RE

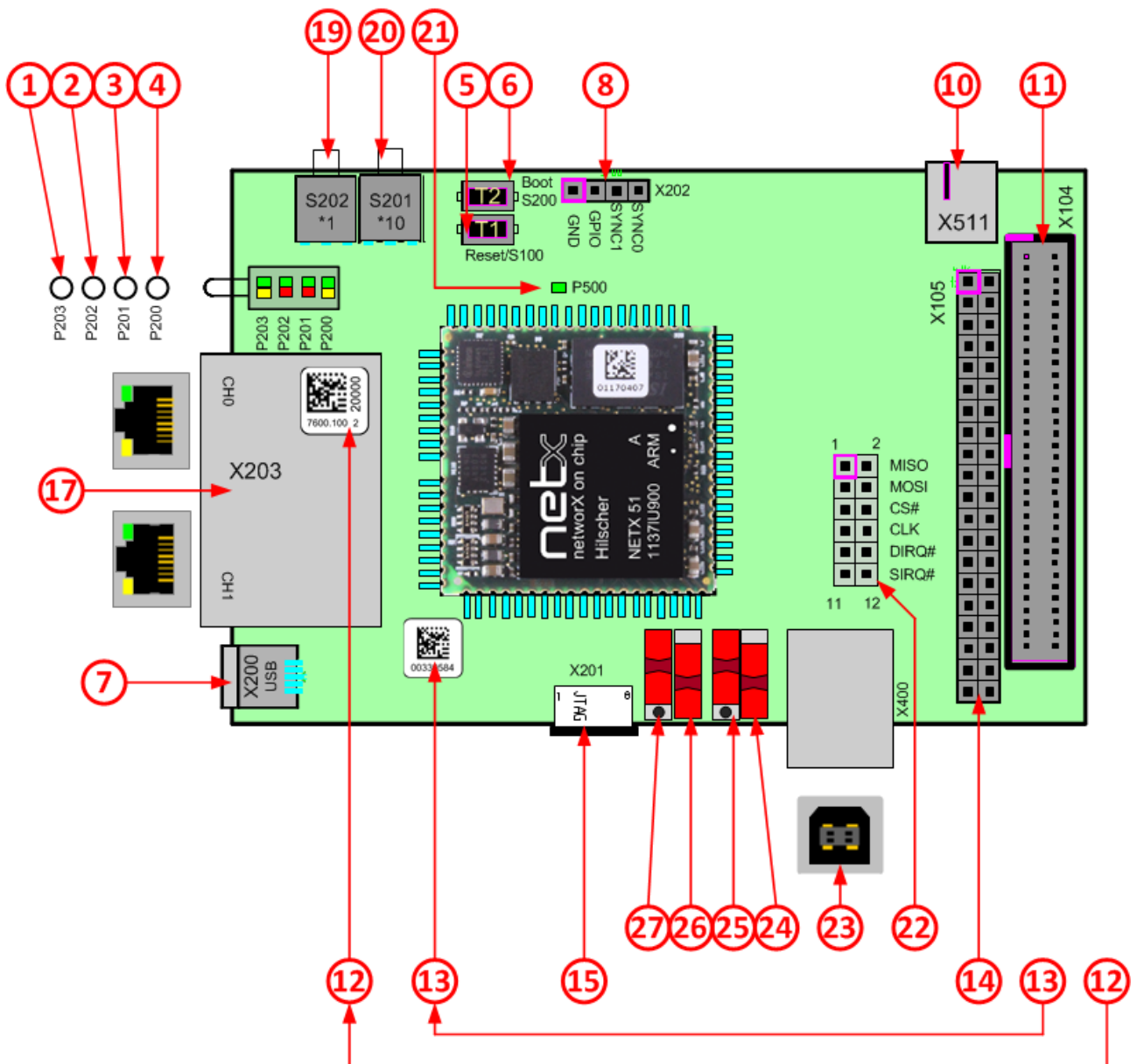


Figure 21: Evaluation Board NRPEB 51-RE

Note: Positions 9, 16 and 18 are left out to keep identical numbering with the other Evaluation Boards.

No. in figure	Name	Description	Page
(1)	P203	LED GPIO	-
(2)	P202	LED COM1	-
(3)	P201	LED COM0	-
(4)	P200	LED SYS	-
(5)	S100	Reset button	53
(6)	S200	Button for serial boot mode	53
(7)	X200	USB interface (Mini-USB)	60
(8)	X202	SYNC and GPIO measuring points	57

No. in figure	Name	Description	Page
-	-	-	-
(10)	X511	Connector for power supply	62
(11)	X104	Host interface	54
(12)	-	Matrix label (part number, hardware revision and serial number)	17
(13)	-	Label with production number	-
(14)	X105	Host interface measuring points	56
(15)	X201	JTAG interface, foil connector (for Hilscher development and production only)	61
-	-	-	-
(17)	X203	Ethernet interface (RJ45 socket)	50
-	-	-	-
(19)	S202	Address switch * 1	52
(20)	S201	Address switch * 10	
(21)	P500	Power LED	-
(22)	X300	SPM pin header	59
(23)	X400	USB interface for SPM	
(24)	S301	Switch between SPM via USB / via pin header	
(25)	S300	Switch between DPM/SPM	
(26)	S204	Host interface mode setting	
(27)	S203	8/16 bit mode setting in parallel dual-port memory mode	

Table 32: Positions on NRPEB 51-RE

Section *Host interface mode NRPEB 51-RE (S203, S204, S300, S301)* on page 59 shows the settings for the switches to activate one host interface mode.

7.2.1 Ethernet interface (X203)

Ethernet on RJ45 Pin Assignment

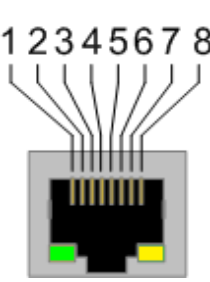
Ethernet	Pin	Signal	Description
 <p>RJ45 socket, female</p>	1	TX+	Transmit data positive
	2	TX-	Transmit data negative
	3	RX+	Receive data positive
	4	Term 1	Connected and terminated to PE via RC combination (Bob Smith Termination)
	5	Term 1	
	6	RX-	Receive data negative
	7	Term 2	Connected and terminated to PE via RC combination (Bob Smith Termination)
	8	Term 2	

Table 33: Ethernet RJ45 pin assignment

7.2.2 Address switches for Ethernet (S201, S202)

Note: Address switches are for future use, as the Ethernet firmware does not read the positions of the switches.

7.3 Evaluation Board NRPEB 52-RE

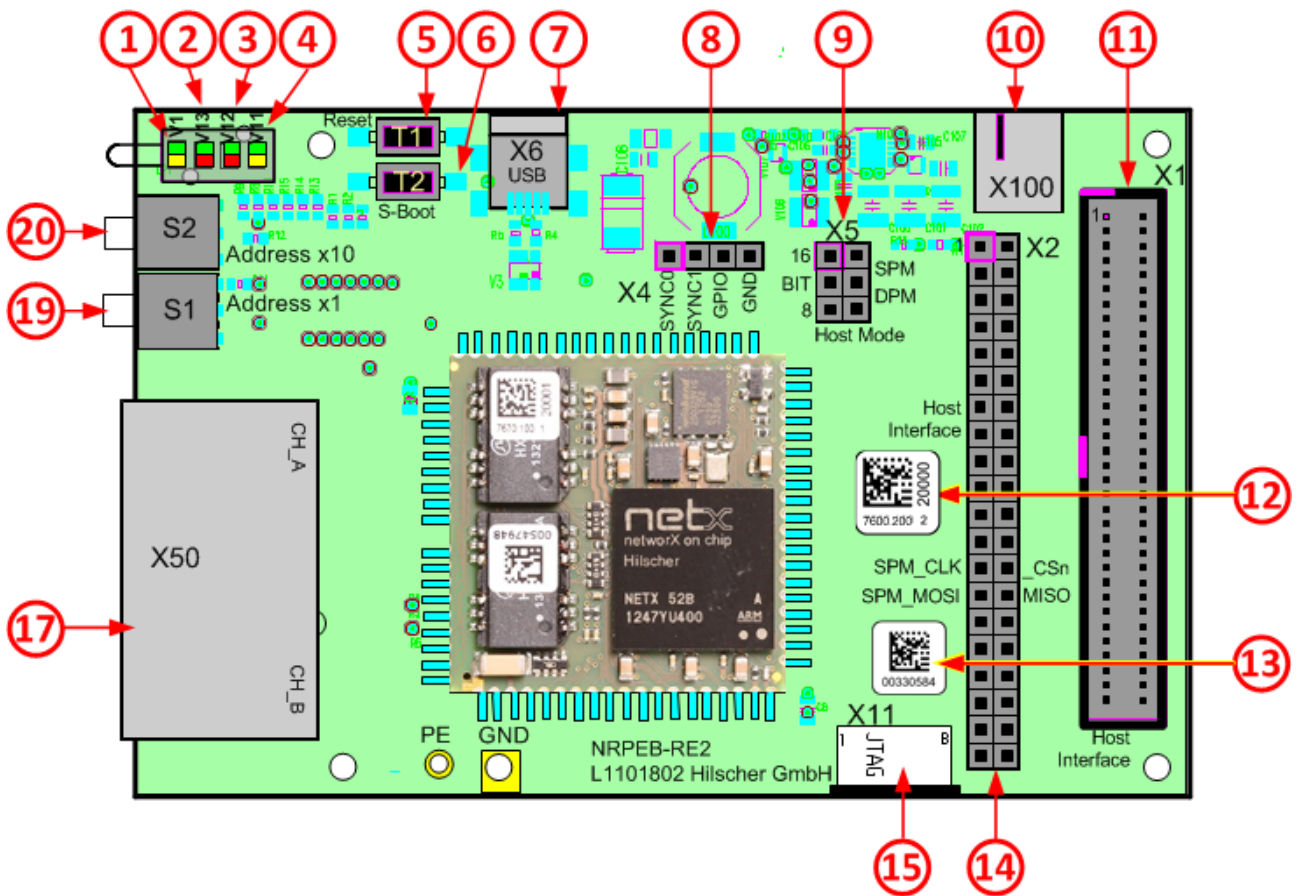


Figure 22: Evaluation Board NRPEB 52-RE

Note: Positions 16 and 18 are left out to keep identical numbering with the other Evaluation Boards.

No. in figure	Name	Description	Page
(1)	V1	LED GPIO	-
(2)	V13	LED COM1	-
(3)	V12	LED COM0	-
(4)	V11	LED SYS	-
(5)	T1	Reset button	53
(6)	T2	Button for serial boot mode	53
(7)	X6	USB interface (Mini-USB)	60
(8)	X4	SYNC and GPIO measuring points	57
(9)	X5	Host interface mode setting	58
(10)	X100	Connector for power supply	62
(11)	X1	Host interface	54
(12)	-	Matrix label (part number, hardware revision and serial number)	17
(13)	-	Label with production number	-
(14)	X2	Host interface measuring points	56
(15)	X11	JTAG interface, foil connector (for Hilscher development and production only)	61
-	-	-	-

No. in figure	Name	Description	Page
(17)	X50	Ethernet interface (RJ45 socket)	52
-	-	-	-
(19)	S1	Address switch Station address * 1	52
(20)	S2	Address switch Station address * 10	

Table 34: Positions on NRPEB 52-RE

7.3.1 Ethernet interface (X50)

Ethernet on RJ45 Pin Assignment

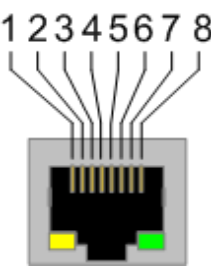
Ethernet	Pin	Signal	Description
 <p>RJ45 socket, female</p>	1	TX+	Transmit data positive
	2	TX-	Transmit data negative
	3	RX+	Receive data positive
	4	Term 1	Connected and terminated to PE via RC combination (Bob Smith Termination)
	5	Term 1	
	6	RX-	Receive data negative
	7	Term 2	Connected and terminated to PE via RC combination (Bob Smith Termination)
	8	Term 2	

Table 35: Ethernet RJ45 pin assignment

7.3.2 Address switches for Ethernet (S1, S2)

Note: Address switches are for future use, as the Ethernet firmware does not read the positions of the switches.

7.4 Operating elements of Evaluation Boards

7.4.1 Reset button (T1)


T1	Function
	Resets the chip carrier. When pressed, pin 41 is connected to GND.

Table 36: Reset button T1

Position **(5)** in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.

7.4.2 S-Boot button (T2)

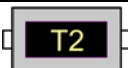
T2	Function
	Activating the serial boot mode via UART or USB. This signal is evaluated after a reset of the chip during start-up phase. In serial boot mode, communication from the boot wizard application to the chip is possible. When pressed, pin 60 is connected to GND.

Table 37: S-Boot button T2

Position **(6)** in

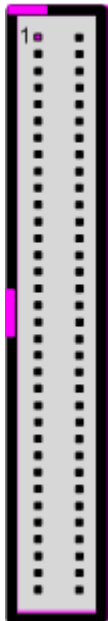
- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.
-

7.5 Interfaces

7.5.1 Host interface (X1/X104)

Connector X1 has the signals of the host interface. X1 is a 68-pin connector.

X1	Pin	Signal	Pin (chip carrier)	Description
	1	+3V3	-	+3.3V Power Supply
	2	GND	-	Ground
	3	-		
	4	-		
	5	GND	-	Ground
	6	-		
	7	RESETn	41	Dual-Port Memory Reset
	8	-		
	9	-		
	10	-		
	11	DPM_DIRQn	39	Dual-Port Memory Data Interrupt
	12	DPM_BUSYn	38	Dual-Port Memory Busy
	13	GND		Ground
	14	DPM_RDn	36	Dual-Port Memory Read
	15	-		
	16	DPM_WRn	37	Dual-Port Memory Write
	17	-		
	18	NRPEB 51-RE only: DPM_SIRQn	40	Dual-Port Memory Sync Interrupt
	19	DPM_BHEn	35	Dual-Port Memory Bus High Enable
	20	GND	-	Ground
	21	-		
	22	-		
	23	-		
	24	DPM_CSn	34	Dual-Port Memory Chip Select
	25	GND		Ground
	26	-		
	27	-		
	28	-		
	29	-		
	30	-		
	31	-		
	32	-		
	33	-		
	34	-		
	35	-		
	36	DPM_A13	33	Dual-Port Memory Address 13
	37	DPM_A12	32	Dual-Port Memory Address 12
	38	DPM_A11	31	Dual-Port Memory Address 11



X1	Pin	Signal	Pin (chip carrier)	Description
	39	DPM_A10	30	Dual-Port Memory Address 10
	40	DPM_A9	29	Dual-Port Memory Address 9
	41	DPM_A8	28	Dual-Port Memory Address 8
	42	DPM_A7	27	Dual-Port Memory Address 7
	43	DPM_A6	26	Dual-Port Memory Address 6
	44	DPM_A5	25	Dual-Port Memory Address 5
	45	DPM_A4	24	Dual-Port Memory Address 4
	46	DPM_A3	23	Dual-Port Memory Address 3
	47	DPM_A2	22	Dual-Port Memory Address 2
	48	DPM_A1	21	Dual-Port Memory Address 1
	49	DPM_A0	20	Dual-Port Memory Address 0
	50	GND	-	Ground
	51	DPM_D15	17	Dual-Port Memory Data 15
	52	DPM_D14	16	Dual-Port Memory Data 14
	53	DPM_D13 SPM_SIRQn	15	Dual-Port Memory Data 13
	54	DPM_D12 SPM_DIRQn	14	Dual-Port Memory Data 12
	55	DPM_D11 SPM_CLK	13	Dual-Port Memory Data 11
	56	DPM_D10 SPM_CSn	12	Dual-Port Memory Data 10
	57	DPM_D9 SPM_MOSI	11	Dual-Port Memory Data 9
	58	DPM_D8 SPM_MISO	10	Dual-Port Memory Data 8
	59	DPM_D7	9	Dual-Port Memory Data 7
	60	DPM_D6	8	Dual-Port Memory Data 6
	61	DPM_D5	7	Dual-Port Memory Data 5
	62	DPM_D4	6	Dual-Port Memory Data 4
	63	DPM_D3	5	Dual-Port Memory Data 3
	64	DPM_D2	4	Dual-Port Memory Data 2
	65	DPM_D1	3	Dual-Port Memory Data 1
	66	DPM_D0	2	Dual-Port Memory Data 0
	67	+3V3	-	+3.3V Power Supply
	68	GND	-	Ground

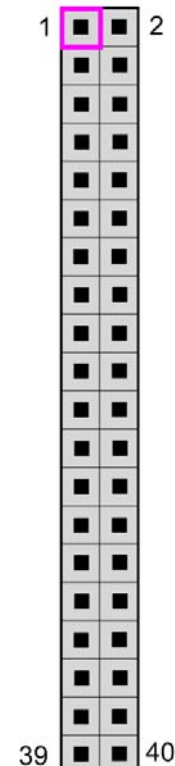
Table 38: Pin assignment X1

Position **(11)** in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.

7.5.2 Host interface measuring pins (X2/X105)

Connector X2/X105 has the signals of the host interface. X2/X105 is a 40-pin connector.

X2	Pin	Signal	Pin (chip carrier)	Description
	1	RESETn	41	Dual-Port Memory Reset
	2	DPM_SIRQn	40	Dual-Port Memory Sync Interrupt
	3	DPM_DIRQn HIFM0	39	Dual-Port Memory Data Interrupt Host Interface Mode 0
	4	DPM_BUSYn	38	Dual-Port Memory Busy
	5	DPM_WRn	37	Dual-Port Memory Write
	6	DPM_RDn	36	Dual-Port Memory Read
	7	DPM_BHEn	35	Dual-Port Memory Bus High Enable
	8	DMP_CSn	34	Dual-Port Memory Chip Select
	9	DPM_A13	33	Dual-Port Memory Address 13
	10	DPM_A12	32	Dual-Port Memory Address 12
	11	DPM_A11	31	Dual-Port Memory Address 11
	12	DPM_A10	30	Dual-Port Memory Address 10
	13	DPM_A9	29	Dual-Port Memory Address 9
	14	DPM_A8	28	Dual-Port Memory Address 8
	15	DPM_A7	27	Dual-Port Memory Address 7
	16	DPM_A6	26	Dual-Port Memory Address 6
	17	DPM_A5	25	Dual-Port Memory Address 5
	18	DPM_A4	24	Dual-Port Memory Address 4
	19	DPM_A3	23	Dual-Port Memory Address 3
	20	DPM_A2	22	Dual-Port Memory Address 2
	21	DPM_A1	21	Dual-Port Memory Address 1
	22	DPM_A0	20	Dual-Port Memory Address 0
	23	DPM_D15	17	Dual-Port Memory Data 15
	24	DPM_D14	16	Dual-Port Memory Data 14
	25	DPM_D13 SPM_SIRQn	15	Dual-Port Memory Data 13 Serial-Host-Memory Sync interrupt
	26	DPM_D12 SPM_DIRQn	14	Dual-Port Memory Data 12 Serial-Host-Memory data interrupt
	27	DPM_D11 SPM_CLK	13	Dual-Port Memory Data 11 Serial-Host-Memory SPI_CLK
	28	DPM_D10 SPM_CSn	12	Dual-Port Memory Data 10 Serial-Host Memory SPI_CSn
	29	DPM_D9 SPM_MOSI	11	Dual-Port-Memory Data 9 Serial-Host Memory SPI_MOSI
	30	DPM_D8 SPM_MISO	10	Dual-Port Memory Data 8 Serial-Host Memory SPI_MISO
	31	DPM_D7	9	Dual-Port Memory Data 7
	32	DPM_D6	8	Dual-Port Memory Data 6
	33	DPM_D5	7	Dual-Port Memory Data 5
	34	DPM_D4	6	Dual-Port Memory Data 4
	35	DPM_D3	5	Dual-Port Memory Data 3

X2	Pin	Signal	Pin (chip carrier)	Description
	36	DPM_D2	4	Dual-Port Memory Data 2
	37	DPM_D1	3	Dual-Port Memory Data 1
	38	DPM_D0	2	Dual-Port Memory Data 0
	39	+3V3		+3.3V Power Supply
	40	GND		Ground

Table 39: Pin assignment X2

Position (14) in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.

7.5.3 SYNC, serial (UART) and GPIO measuring pins (X4/X202)

X4	Pin	Signal	Pin (chip carrier)	Description		
SYNC0	1	UART_RxD	SYNC0	42	UART Receive Data	Synchronization Signal 0
SYNC1	2	UART_TxD	SYNC1	43	UART Transmit Data	Synchronization Signal 1
GPIO	3	GPIO		66	General Purpose In- / Output	
GND	4	GND		-	Ground	

Table 40: Pin Assignment X4 (NRPEB 52-RE)/X202 (NRPEB 51-RE)

Position (8) in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRP 52-RE.

7.5.4 Host interface mode NRPEB 10-CCS, NRPEB 10-DPS, and NRPEB 52-RE (X5)

The following applies only for NRPEB 10-CCS, NRPEB 10-DPS and NRPEB 52-RE:

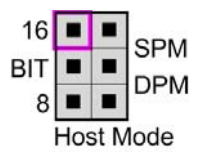
X5	Pin	Signal	Pin (chip carrier)	Description
	1	Low		via 2.2 kΩ to GND
	2	Low		via 2.2 kΩ to GND
	3	DPM_STRQ	40	
	4	DPM_DIRQ	39	
	5			open
	6			open

Table 41: Pin Assignment X5

Position (9) in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS, and
- Figure 22 on page 51 for NRPEB 52-RE.

Set host interface

Use a jumper to set the host interface mode. The mode is read during the start-up phase. If parallel dual-port memory mode is set, then the data width of 8 or 16 bit has to be selected.

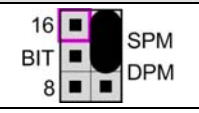
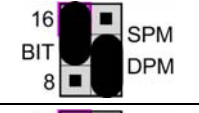
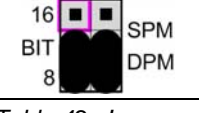
X5	Host Interface Mode	Jumper Position
	Serial dual-port memory mode	Jumper from pin 2 to 4.
	Parallel dual-port memory mode 16 bit	Jumper from pin 4 to 6 and jumper from pin 1 to 3.
	Parallel dual-port memory mode 8 bit	Jumper from pin 4 to 6 and jumper from pin 3 to 5.

Table 42: Jumper position to set host interface mode

On NRPEB 51-RE, the host interface mode is selected with the slide switches S203, S204 and S300, see section Host interface mode NRPEB 51-RE (S203, S204, S300, S301) on page 59.

7.5.5 Host interface mode NRPEB 51-RE (S203, S204, S300, S301)

At any particular time only one of the three host interfaces X104 (11), X300 (22) or X400 (23) can be used. Table 43 shows the settings of the switches to activate one host interface.





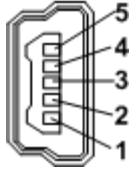
Activated host interface	Connection	S203 position (27)	S204 position (26)	S300 position (25)	S301 position (24)
16-bit parallel dual-port memory mode	X104, position (11)				Setting is not relevant
8-bit parallel dual-port memory mode	X104, position (11)				Setting is not relevant
Serial port memory via host interface connector	X104, position (11)	Setting is not relevant			Setting is not relevant
Serial port memory via USB	SPM-USB X400, position (23)	Setting is not relevant			
Serial port memory via pin header	Pin header X300, position (22)	Setting is not relevant			

Table 43: Settings for selecting the host interface (NRPEB 51-RE)

7.5.6 USB interface (X6/X200)

mini USB jack	Pin USB	Signal	Pin Device	Description
	1			
	2	D-	44	Data -; has to be protected with a 22 Ω resistor.
	3	D+	45	Data +; has to be protected with a 22 Ω resistor.
	4			
	5	GND		Ground

Position **(7)** in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.

7.5.7 JTAG connector (X11/X201)


X5	Pin	Signal
	1	+3.3 V
	2	BSCAN_TRST#
	3	JT_TCK
	4	JT_TDO
	5	JT_TD1
	6	JT_TMS
	7	JT_TRSTN
	8	GND

Table 44: Pin assignment JTAG connector

NXAC-JTAG Interface:

Connector: SEK-18 SV MA LP STR29 20P PL3 to film

Dimensions: 43.2 x 43.2 mm

Interface not isolated

Order Number: 2400.000

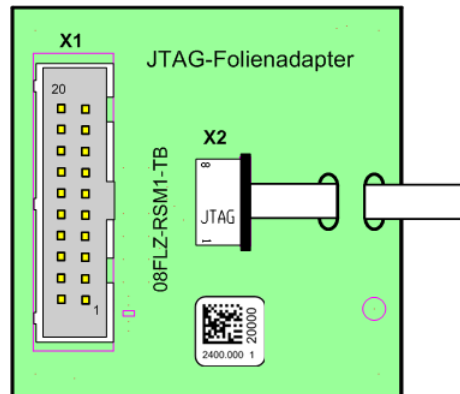


Figure 23: NXAC-JTAG foil adapter

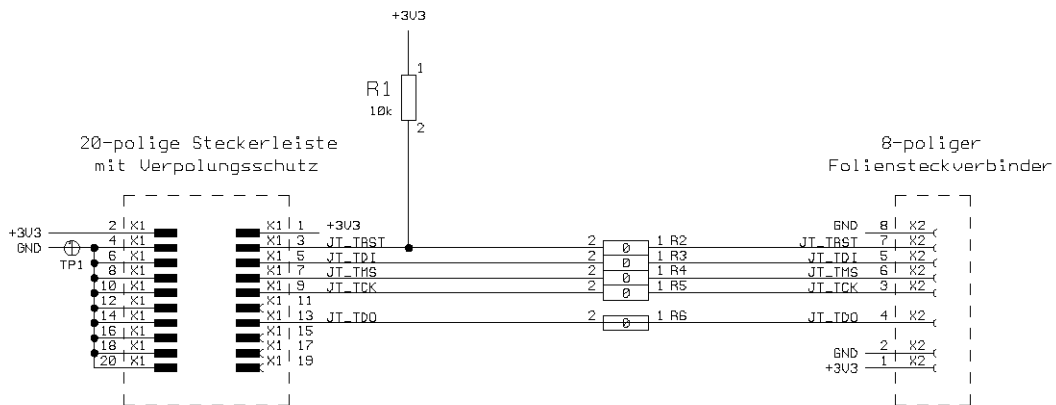
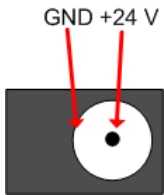


Figure 24: NXAC-JTAG schematics

7.5.8 Power supply (X100/X511)

The Evaluation board has to be supplied by DC. VIN is from 18 V to 30 V. The typical supply voltage is 24 V.



Pin	Description
1	GND Ground
2	VIN 18 - 30 V DC

The evaluation board supplies the netRAPID device with 3.3 V operating voltage.

Position (10) in

- Figure 20 on page 44 for NRPEB 10-CCS and NRPEB 10-DPS,
- Figure 21 on page 48 for NRPEB 51-RE, and
- Figure 22 on page 51 for NRPEB 52-RE.

The connection for the power supply is suitable for the power supply **NXAC-Power**.

The power supply NXAC-POWER has the following technical data:

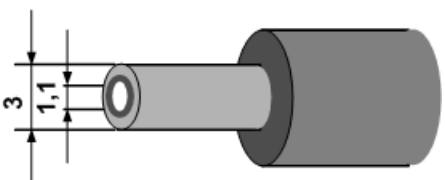
NXAC-POWER	Value
Part number	7930.000
Input	100-240 V ~0,4 A (47-63 Hz)
Output	24 V / 0,625 A, short-circuit-proof
Cable length	1,8 m
Connector	With barrel connector, sizes in mm  Figure 25: Sizes of barrel connector NXAC-POWER

Table 45: Technical data power supply NXAC-POWER

7.5.9 SPM Interface NRPEB 51-RE (X300)

The SPI interface provides signals for connecting to a host system (i.e. SPI master) and is a SPM via SPI interface (position (22) in Figure 21 on page 48).

The signals of the serial dual-port memory interface of the evaluation board NRPEB 51-RE can be routed to the pin header X300 (12-pin). To activate SPM interface at X300, set the switches to **Serial port memory via pin header** as documented in Table 43 on page 59.

The pin assignment of pin header X300 is as follows:

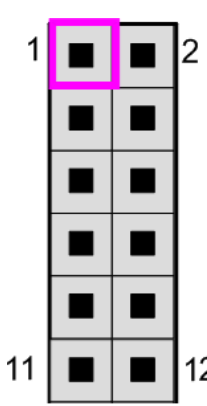
Pin Header X300	Pin	Signal
	1	SPM_SIRQn
	2	+3V3 Output
	3	SPM_DIRQn
	4	GND
	5	SPM_CLK
	6	GND
	7	SPM_CSn
	8	GND
	9	SPM_MOSI
	10	GND
	11	SPM_MISO
	12	GND

Table 46: Pin assignment of pin header X300

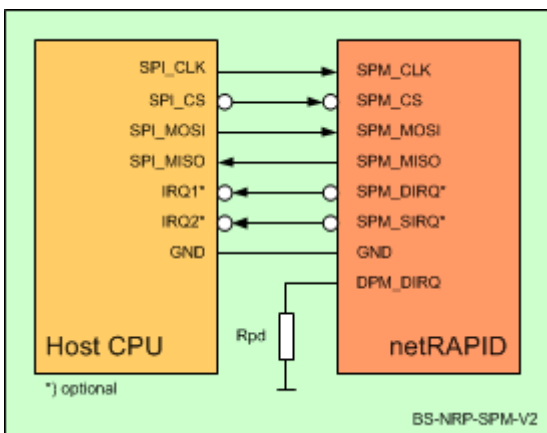


Figure 26: SPI-master-slave-connection

This figure also shows the signal directions. At least the signals SPM_CLK, SPM_CS#, SPM_MOSI und SPM_MISO and GND must be connected.

7.5.10 USB interface for SPM - NRPEB 51-RE (X400)

USB Interface X400 (position (23) in Figure 21 on page 48) can be used for accessing the serial dual-port memory.

To activate this interface use the setting for "Serial port memory via USB" as listed in Table 43 on page 59.

8 Technical data

8.1 CC-Link

8.1.1 netRAPID Chip Carrier NRP 10-CCS

NRP 10-CCS	Parameter	Value
Device identification	Part number	7650.740
Communication interface	Field bus	CC-Link Slave
CC-Link Interface	Transmission rate	156 kBit/s, 625 kBit/s, 2500 kBit/s, 5 MBit/s, 10 MBit/s
	Interface Type	RS-485
	Galvanic Isolation	optically isolated
Communication controller	Type	netX 10
Memory	FLASH	4 MB serial Flash EPROM
Host interface	Type	Parallel Dual-port memory or serial Dual-port memory (SPI)
	Dual-port memory size	16 KB (14 address lines), where 8 KB used by firmware (13 address lines, lowest 8 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, mode 3 (CPOL = 1, CPHA = 1)
	Serial transmission rate	Max. 50 MHz
	Connector Type	76-pin solder contacts 1 mm with 1.5 mm grid
Diagnostic Interface	USB	Signals at chip carrier (supported by standard firmware) Available only if integrated in host system
	UART	RXD, TXD signals at chip carrier (not supported by standard firmware)
Display	LED Display	Signals at chip carrier SYS System Status L RUN/L ERR Communication status
Power supply	Voltage	+3.3 V ± 5 % DC
	Current at 3.3 V (typ.)	360 mA
	Current at 3.3 V (max.)	710 mA
	Power Consumption (typ.)	1.2 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	0 ... +70 °C
	Air flow	0.5 m/s
Dimensions	L x W x H	32 x 32 x 4 mm
Weight	Weight	approx. 4 g

Table 47: Technical data NRP 10-CCS

8.1.2 Evaluation Board NRPEB 10-CCS

NRPEB 10-CCS	Parameter	Value
Device identification	Part number	7600.740
Chip carrier	Type	NRP 10-CCS
Field bus	Interface	CC-Link Slave
	Connector	Combicon 5-pin , male connector
Host interface	Type	Parallel dual-port memory or serial dual-port memory (SPI)
	Connector Type	68-pin (X1) or 40-pin (X2)
Diagnostic Interface	USB	Mini-B USB
	UART	Pin header
Display	LED	SYS System Status
		COM0, COM1 Communication status
		GPIO Status
Operating elements	Buttons	Reset push button Serial boot mode push button
	Switch	Baud rate switch Address switch (*1) Address switch (*10)
Power supply	Voltage	24 V ± 6 V DC
	Current at 24 V (typ.)	55 mA
	Power Consumption	1.3 W (at 24 V)
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	0 ... +70 °C
	Air flow	0.5 m/s
Dimensions	(L x W x H)	100 x 65 x 12 mm
Weight	Weight	approx. 45 g

Table 48: Technical data Evaluation Board NRPEB 10-CCS

8.2 PROFIBUS DP Slave

8.2.1 netRAPID Chip Carrier NRP 10-DPS

NRP 10-DPS	Parameter	Value
Device identification	Part number	7650.420
Communication controller	Type	netX 10
Memory	FLASH	4 MB serial Flash EPROM
Communication interface	Field bus	PROFIBUS DP Slave
PROFIBUS Interface	Transmission rate	9,6 kBit/s, 19,2 kBit/s, 31,25 kBit/s, 45,45 kBit/s, 93,75 kBit/s, 187,5 kBit/s, 500 kBit/s, 1,5 MBit/s, 3 MBit/s, 6 MBit/s, 12 MBit/s
	Interface Type	RS-485
	Galvanic Isolation	Isolated
Host interface	Type	Parallel Dual-port memory or serial Dual-port memory (SPI)
	Dual-port memory size	16 KB (14 address lines), where 8 KB used by firmware (13 address lines, lowest 8 KB)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, mode 3 (CPOL = 1, CPHA = 1)
	Serial transmission rate	Max. 50 MHz
	Connector Type	76-pin solder contacts 1 mm with 1.5 mm grid
Diagnostic Interface	USB	Signals at chip carrier (supported by standard firmware) Available only if integrated in host system
	UART	RXD, TXD signals at chip carrier (not supported by standard firmware)
Display	LED Display	Signals at chip carrier SYS system status COM communication status
Power supply	Voltage	+3.3 V ± 5 % DC
	Current at 3.3 V (typ.)	290 mA
	Current at 3.3 V (max.)	790 mA
	Power Consumption	1 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions	L x W x H	32 x 32 x 4 mm
Weight	Weight	approx. 3 g

Table 49: Technical data NRP 10-DPS

8.2.2 Evaluation Board NRPEB 10-DPS

NRPEB 10-DPS	Parameter	Value
Device identification	Part number	7600.420
Chip carrier	Type	NRP 10-DPS
Field bus	Interface	PROFIBUS DP Slave
	Connector	D-Sub 9-pin, female
Host interface	Type	Parallel dual-port memory or serial dual-port memory (SPI)
	Connector Type	68-pin (X1) or 40-pin (X2)
Diagnostic Interface	USB	Mini-B USB
	UART	Pin header
Display	LED	SYS system status
		COM0, COM1 communication status
		GPIO status
Operating elements	Buttons	Reset push button Serial boot mode push button
	Switch	Address switch (*1) Address switch (*10)
Power supply	Voltage	24 V ± 6 V DC
	Current at 24 V (typ.)	45 mA
	Power Consumption	1.1 W (at 24 V)
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions	L x W x H	100 x 65 x 12 mm
Weight	Weight	approx. 45 g

Table 50: Technical data NRPEB 10-DPS

8.3 Real-Time Ethernet

8.3.1 netRAPID Chip Carrier NRP 51-RE

NRP 51-RE	Parameter	Value
Device identification	Part number	7660.101
Communication controller	Type	netX 51
Integrated memory	SDRAM	8 MB
	FLASH	4 MB serial Flash EPROM
Ethernet interface	Transmission rate	100 MBit/s 10 MBit/s (depending on loaded firmware)
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	depending on loaded firmware
	Auto-Crossover	depending on loaded firmware
	Galvanic Isolation	Isolated
Host interface	Type	Parallel Dual-port memory or serial Dual-port memory (SPI)
	Dual-port memory size	16 KB (14 address lines)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, mode 3 (CPOL = 1, CPHA = 1)
	Serial transmission rate	Max. 50 MHz
	Connector Type	76-pin solder contacts 1 mm with 1.5 mm grid
Diagnostic Interface	UART	RXD, TXD (depending on loaded firmware)
	USB	Yes
Display	LED Display	Signals at chip carrier SYS system status COM0, COM1 communication status Link0, Link1 Activity0, Activity1
Power supply	Voltage	+3.3 V ± 5 % DC
	Current at 3.3 V (typ.)	560 mA
	Current at 3.3 V (max.)	580 mA
	Power Consumption (typ.)	1.92 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions (L x W x H)		32 x 32 x 3 mm
Weight	Weight	approx. 4 g

Table 51: Technical data NRP 51-RE

8.3.2 netRAPID Chip Carrier NRP 51-RE\F8T (preliminary)

NRP 51-RE\F8T	Parameter	Value
Device identification	Part number	7660.100
Communication controller	Type	netX 51
Integrated memory	SDRAM	8 MB
	FLASH	8 MB serial Flash EPROM
Ethernet interface	Transmission rate	100 MBit/s 10 MBit/s (depending on loaded firmware)
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	depending on loaded firmware
	Auto-Crossover	depending on loaded firmware
	Galvanic Isolation	Isolated
Host interface	Type	Parallel Dual-port memory or serial Dual-port memory (SPI)
	Dual-port memory size	16 KB (14 address lines)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, mode 3 (CPOL = 1, CPHA = 1)
	Serial transmission rate	Max. 50 MHz
	Connector Type	76-pin solder contacts 1 mm with 1.5 mm grid
Diagnostic Interface	UART	RXD, TXD (depending on loaded firmware)
	USB	Yes
Security functions	Security module	TPM (Trusted platform module) V1.2
Display	LED Display	Signals at chip carrier SYS system status COM0, COM1 communication status Link0, Link1 Activity0, Activity1
Power supply	Voltage	+3.3 V ± 5 % DC
	Current at 3.3 V (typ.)	tbd.
	Current at 3.3 V (max.)	tbd.
	Power Consumption (typ.)	tbd.
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	tbd.
	Air flow	0.5 m/s
Dimensions (L x W x H)		32 x 32 x 4 mm
Weight	Weight	approx. 4 g

Table 52: Technical data NRP 51-RE\F8T (preliminary)

8.3.3 netRAPID Chip Carrier NRP 52-RE

NRP 52-RE	Parameter	Value
Device identification	Part number	7670.100
Communication controller	Type	netX 52
Integrated memory	FLASH	4 MB serial Flash EPROM
Ethernet interface	Transmission rate	100 MBit/s 10 MBit/s (depending on loaded firmware)
	Half duplex/Full duplex	supported (at 100 MBit/s)
	Auto-Negotiation	depending on loaded firmware
	Auto-Crossover	depending on loaded firmware
	Galvanic Isolation	Isolated
Host interface	Type	Parallel Dual-port memory or serial Dual-port memory (SPI)
	Dual-port memory size	16 KB (14 address lines)
	Data width (parallel)	8 or 16 bit
	Serial dual-port memory interface	SPI Slave, mode 3 (CPOL = 1, CPHA = 1)
	Serial transmission rate	Max. 50 MHz
	Connector Type	76-pin solder contacts 1 mm with 1.5 mm grid
Diagnostic Interface	UART	RXD, TXD (depending on loaded firmware)
	USB	Yes
Display	LED Display	Signals at chip carrier SYS system status COM0, COM1 communication status Link0, Link1 Activity0, Activity1
Power supply	Voltage	+3.3 V ± 5 % DC
	Current at 3.3 V (typ.)	520 mA
	Current at 3.3 V (max.)	600 mA
	Power Consumption (typ.)	1.8 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions (L x W x H)		32 x 32 x 4 mm
Weight	Weight	approx. 4 g

Table 53: Technical data NRP 52-RE

8.3.4 Evaluation Board NRPEB 51-RE

NRPEB 51-RE	Parameter	Value
Device identification	Part number	7600.100
Chip carrier	Type	NRP 51-RE/F8T
Ethernet interface	Connector	2x RJ45
Host interface	Type	Parallel dual-port memory or serial dual-port memory (SPI)
	Connector Type	68-pin (X104) or 40-pin (X105)
Diagnostic Interface	USB	Mini-B USB
	UART	Pin header
Display	LED Display	SYS System Status
		COM0, COM1 Communication status
		GPIO Status (not supported by standard firmware)
Operating elements	Buttons	Reset push button S-Boot push button
	Switch	Address switch (*1) Address switch (*10) (not supported by standard firmware)
Power supply	Voltage	24 V ± 6 V DC
	Current at 24 V (typ.)	110 mA
	Power Consumption (typ.)	2.6 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions	L x W x H	100 x 65 x 18 mm
Weight	Weight	approx. 45 g

Table 54: Technical data NRPEB 51-RE

8.3.5 Evaluation Board NRPEB 52-RE

NRPEB 52-RE	Parameter	Value
Device identification	Part number	7600.200
Chip carrier	Type	NRP 52-RE
Ethernet interface	Connector	2x RJ45
Host interface	Type	Parallel dual-port memory or serial dual-port memory (SPI)
	Connector Type	68-pin (X1) or 40-pin (X2)
Diagnostic Interface	USB	Mini-B USB
	UART	Pin header
Display	LED Display	SYS System Status
		COM0, COM1 Communication status
		GPIO Status (not supported by standard firmware)
Operating elements	Buttons	Reset push button S-Boot push button
	Switch	Address switch (*1) Address switch (*10) (not supported by standard firmware)
Power supply	Voltage	24 V ± 6 V DC
	Current at 24 V (typ.)	100 mA
	Power Consumption (typ.)	2.4 W
Signal lines	Voltage of IO signal lines	+3.3 V ± 5 %
Environmental conditions	Ambient temperature range for operation	-20 ... +70 °C
	Air flow	0.5 m/s
Dimensions	L x W x H	100 x 65 x 18 mm
Weight	Weight	approx. 45 g

Table 55: Technical data NRPEB 52-RE

8.4 Signals

Input / Output	Min.	Typ.	Max.	Unit
Binary input DI				
V _{IH}	2.0	3.3	3.6	V
V _{IL}	0		0.8	V
I _{Ii}			10	µA
Binary output DO				
Notice: Outputs are not overload protected!				
V _{OH}	2.4		VCC-0.1 V	V
I _{OH}			6	mA

Table 56: Technical data signals

9 Schematics

9.1 Overview

This chapter contains the schematics of the Evaluation Boards. The schematics are an example for the host system. The host CPU, which is a standard PC, is connected via a PC adapter card to the host interface connector (X1).

Function	NRPEB 10-CCS NRPEB 10-DPS	NRPEB 51-RE	NRPEB 52-RE
Host interface	Page 74	Page 76	Page 80
Host mode setting		Pages 77 and 78	
Communication interface		Page 77	
USB diagnostic interface			
SYNC interface and UART diagnostic interface			
Input 2x 4 bit (address switch)			
Input 1x 4 bit (baud rate switch)			
Output 1 bit GPIO			
LED			
S-Boot			
Reset			
Power supply	Page 75	Page 79	Page 81

Table 57: Function overview schematics

9.2 NRPEB 10-CCS and NRPEB 10-DPS

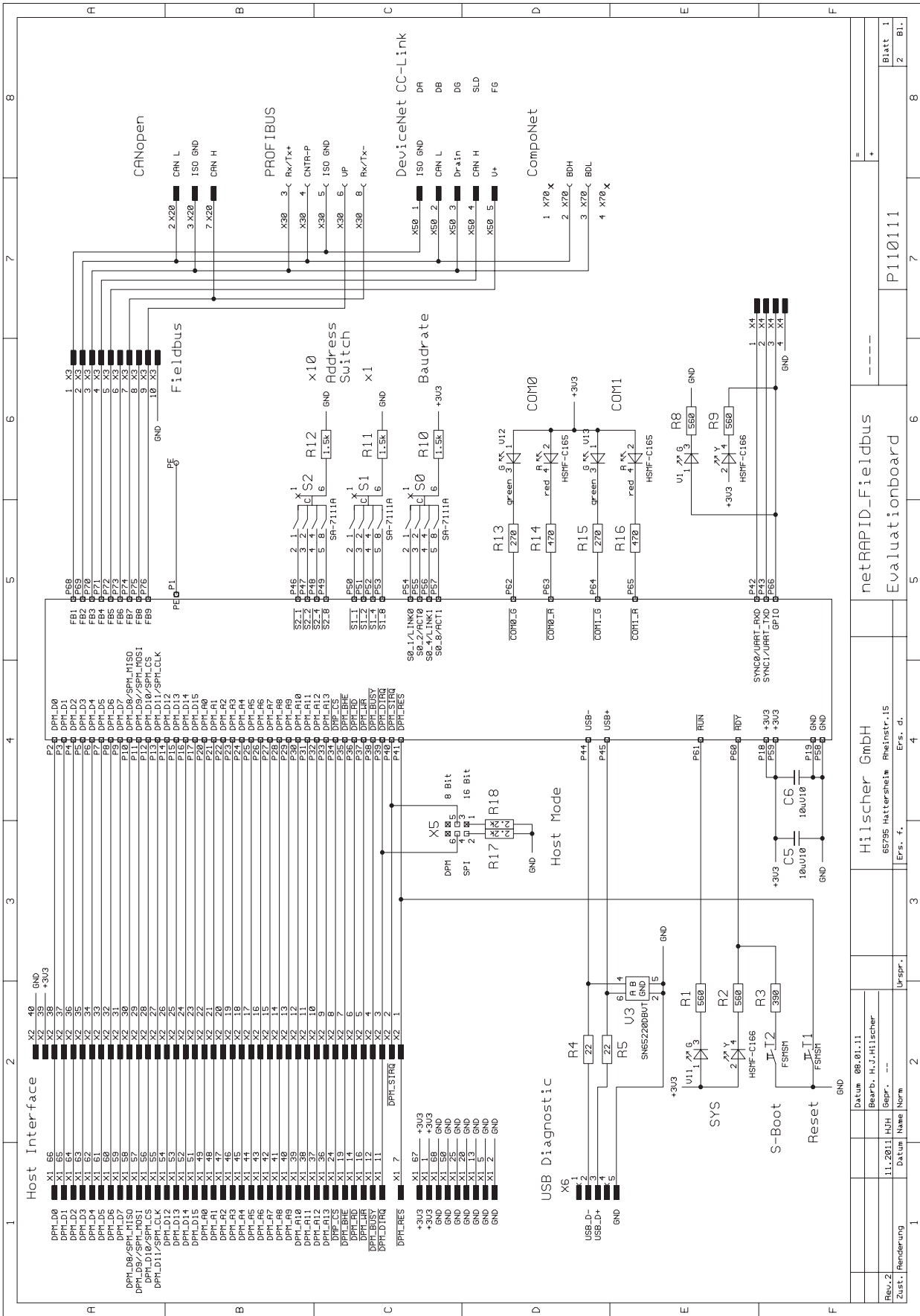


Figure 27: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 1)

Blatt 1		Blatt 2	
netRAPID-Fieldbus		P110111	
Evaluationboard		-----	
Hilscher GmbH		Ers. f.	
65795 Hattersheim		Ers. d.	
Rheinstr. 15			
Rev.-2	11.2011	HJH	Gepr. ---
Zust. / Änderung	Datum	Name	Norm.
		Ur-spr.	

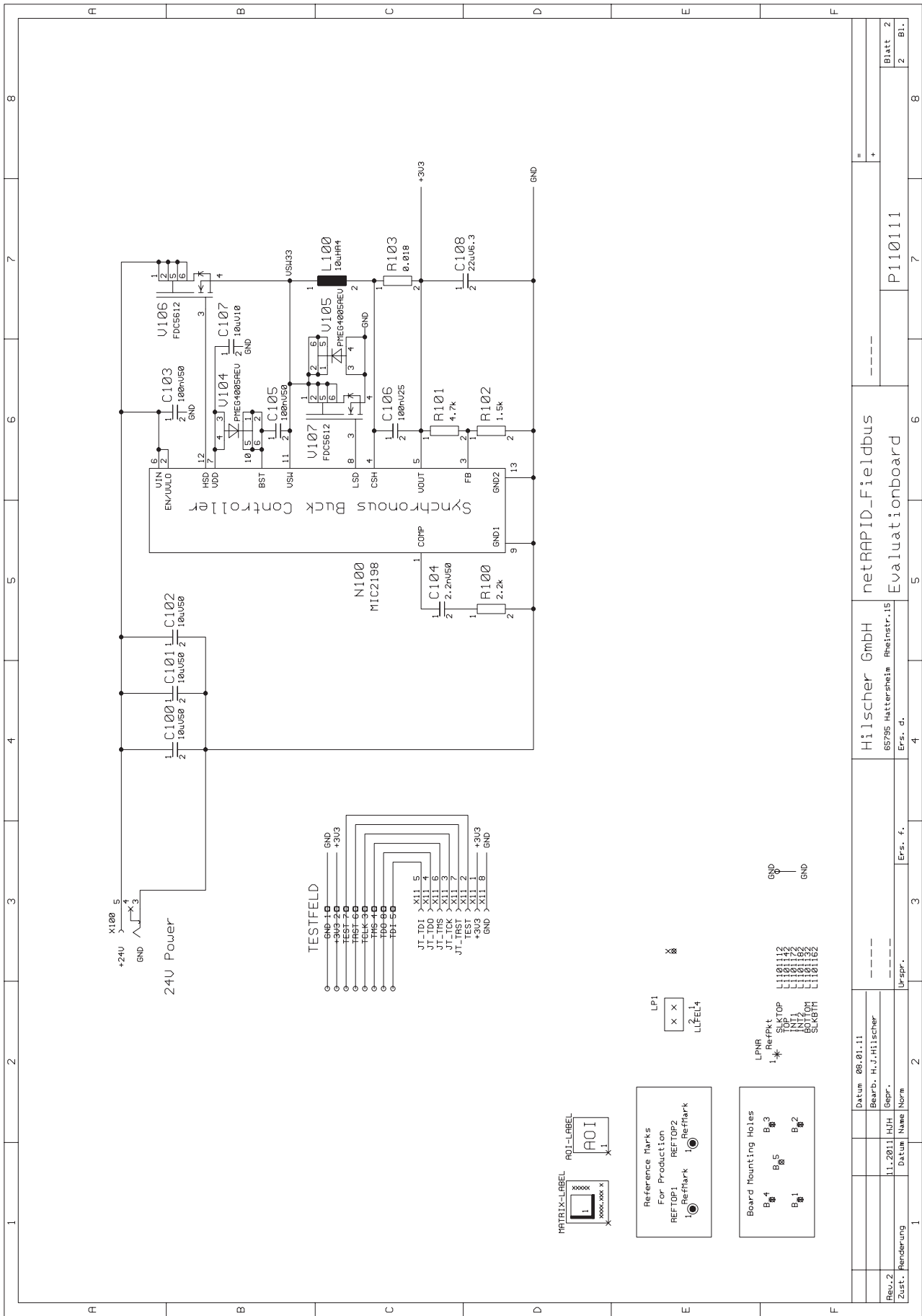
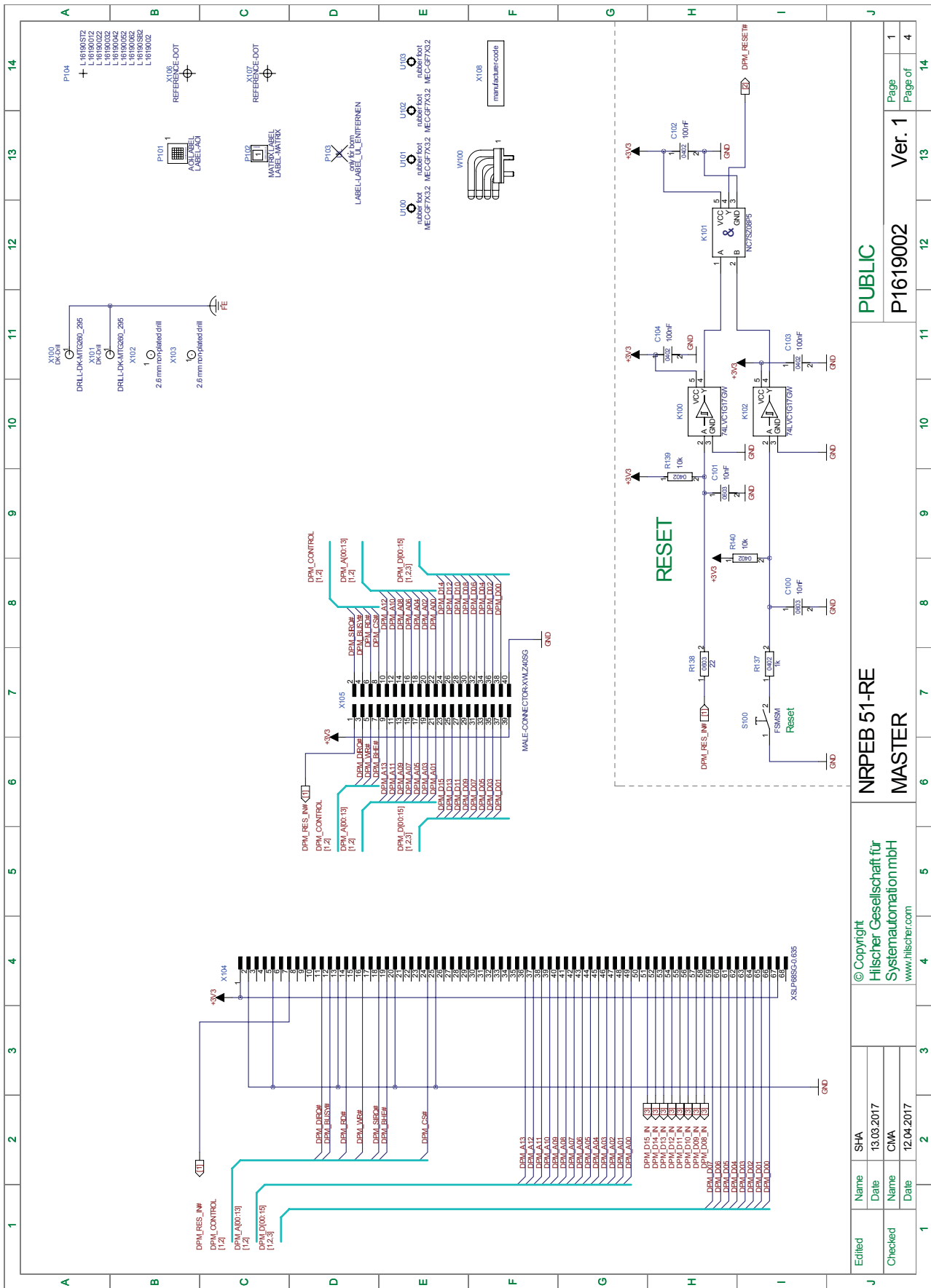


Figure 28: Schematic NRPEB 10-CCS and NRPEB 10-DPS (Part 2)

9.3 NRPEB 51-RE



Edited		Name	SHA
Checked		Date	13.03.2017
		Name	CMA
		Date	12.04.2017
PUBLIC			
NRPEB 51-RE			
MASTER			
© Copyright Hilscher Gesellschaft für Systemautomation mbH www.hilscher.com			
		Ver. 1	Page of 4
		P1619002	Page of 14

Figure 29: Schematic NRPEB 51-RE (Part 1)

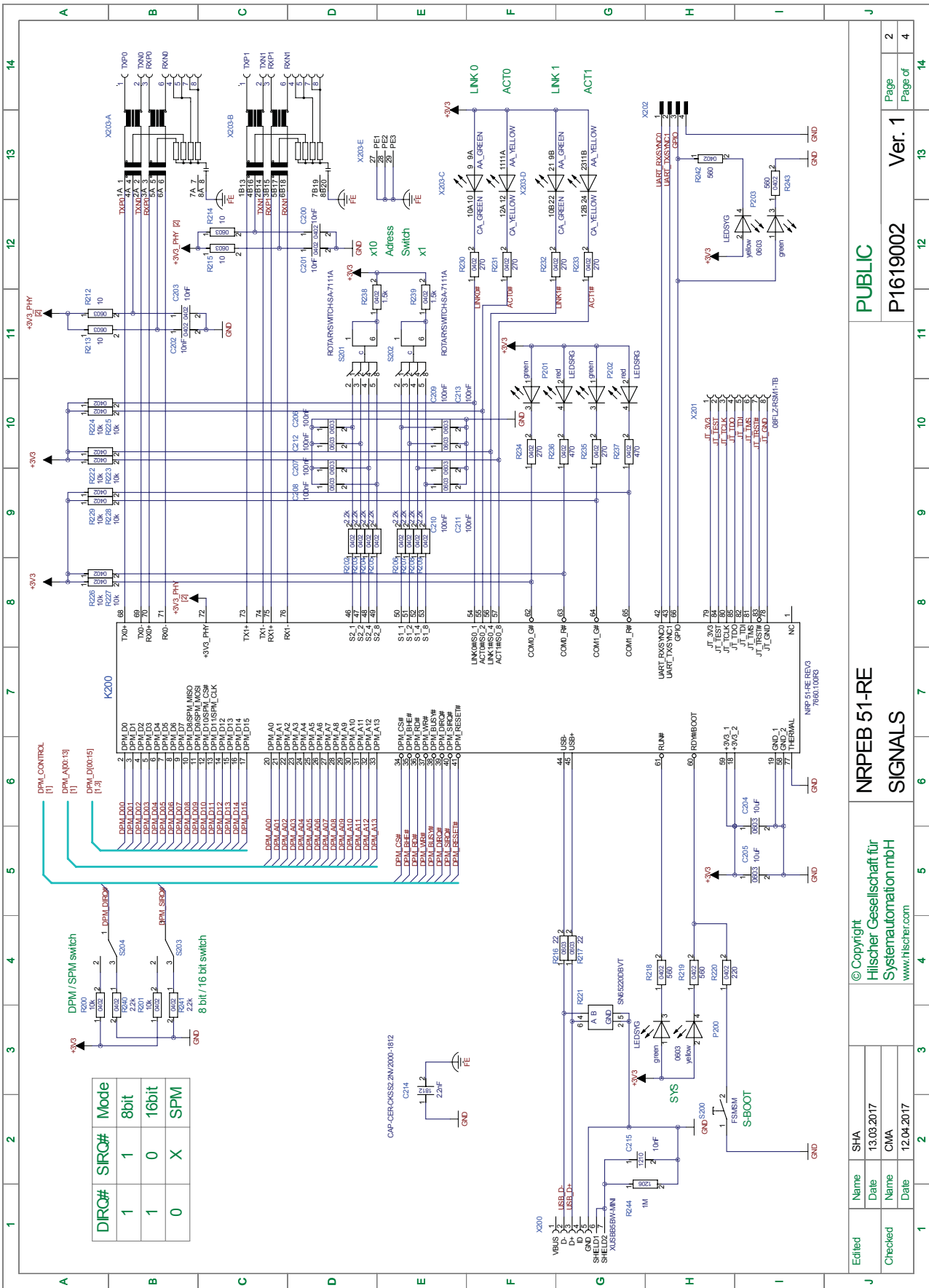


Figure 30: Schematic NRPEB 51-RE (Part 2)

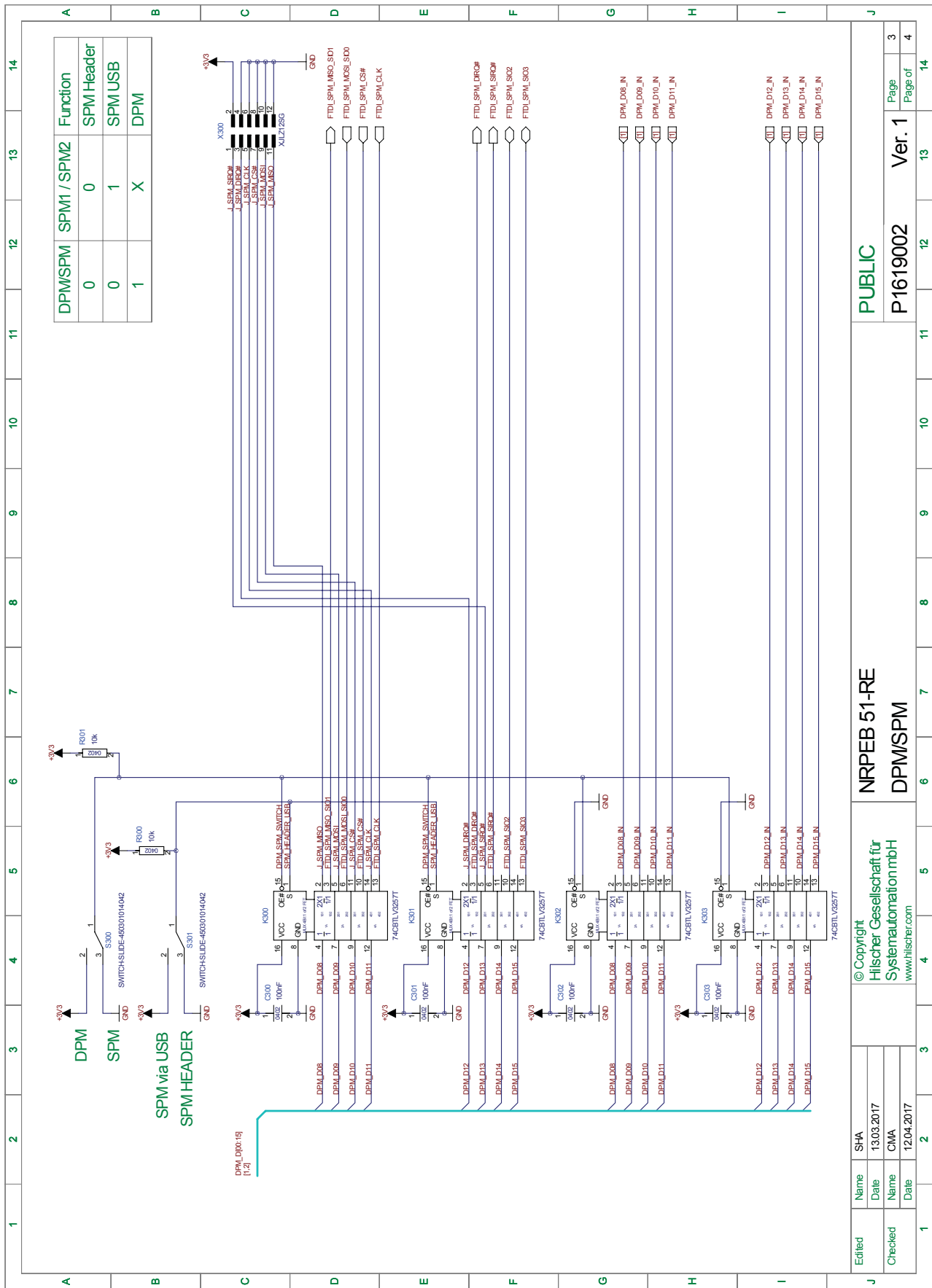


Figure 31: Schematic NRPEB 51-RE (Part 3)

Edited Name SHA Date 13.03.2017		© Copyright Hilscher Gesellschaft für Systemautomation mbH www.hilscher.com		NRPEB 51-RE DPM/SPM		PUBLIC	
Checked Name CMA Date 12.04.2017		Ver. 1		P1619002		Page of 3 Page of 14	

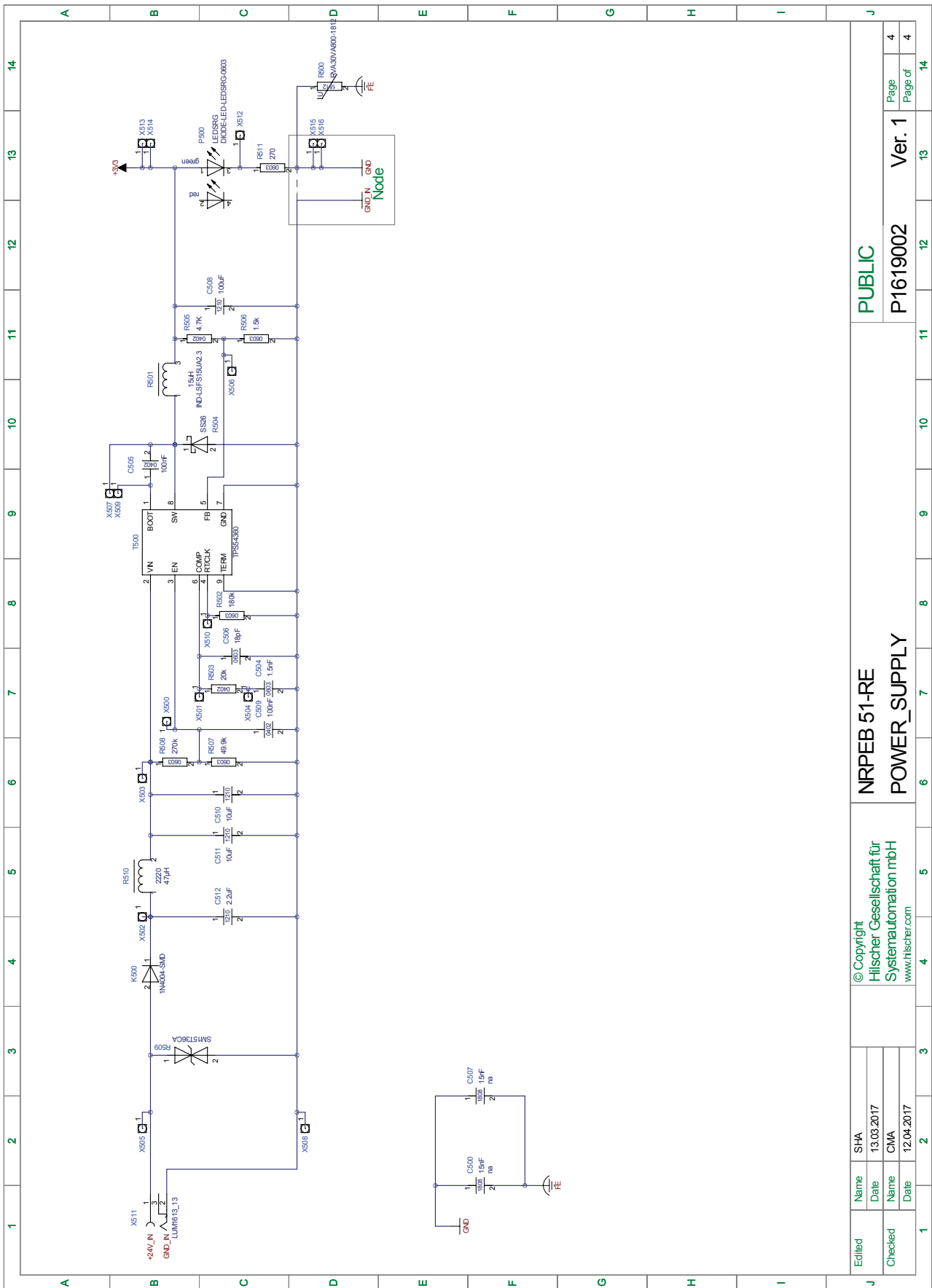


Figure 32: Schematic NRPEB 51-RE (Part 4)

Edited		Name	SHA	NRPEB 51-RE		PUBLIC	
Checked		Date	13.03.2017	P1619002		Ver. 1	
		Name	CMA	POWER_SUPPLY		Page of 4	
		Date	12.04.2017			Page of 14	

9.4 NRPEB 52-RE

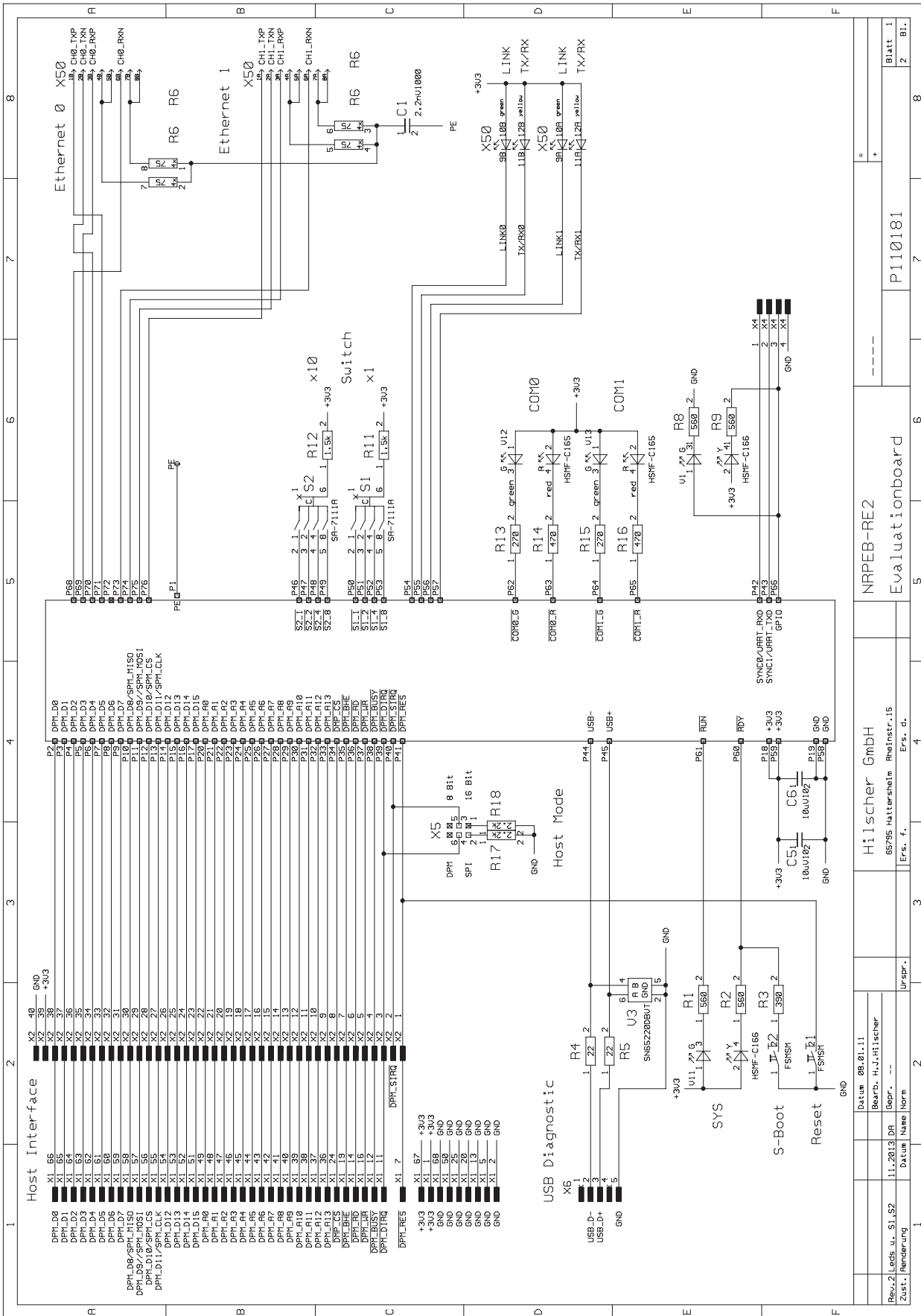


Figure 33: Schematic NRPEB 52-RE (Part 1)

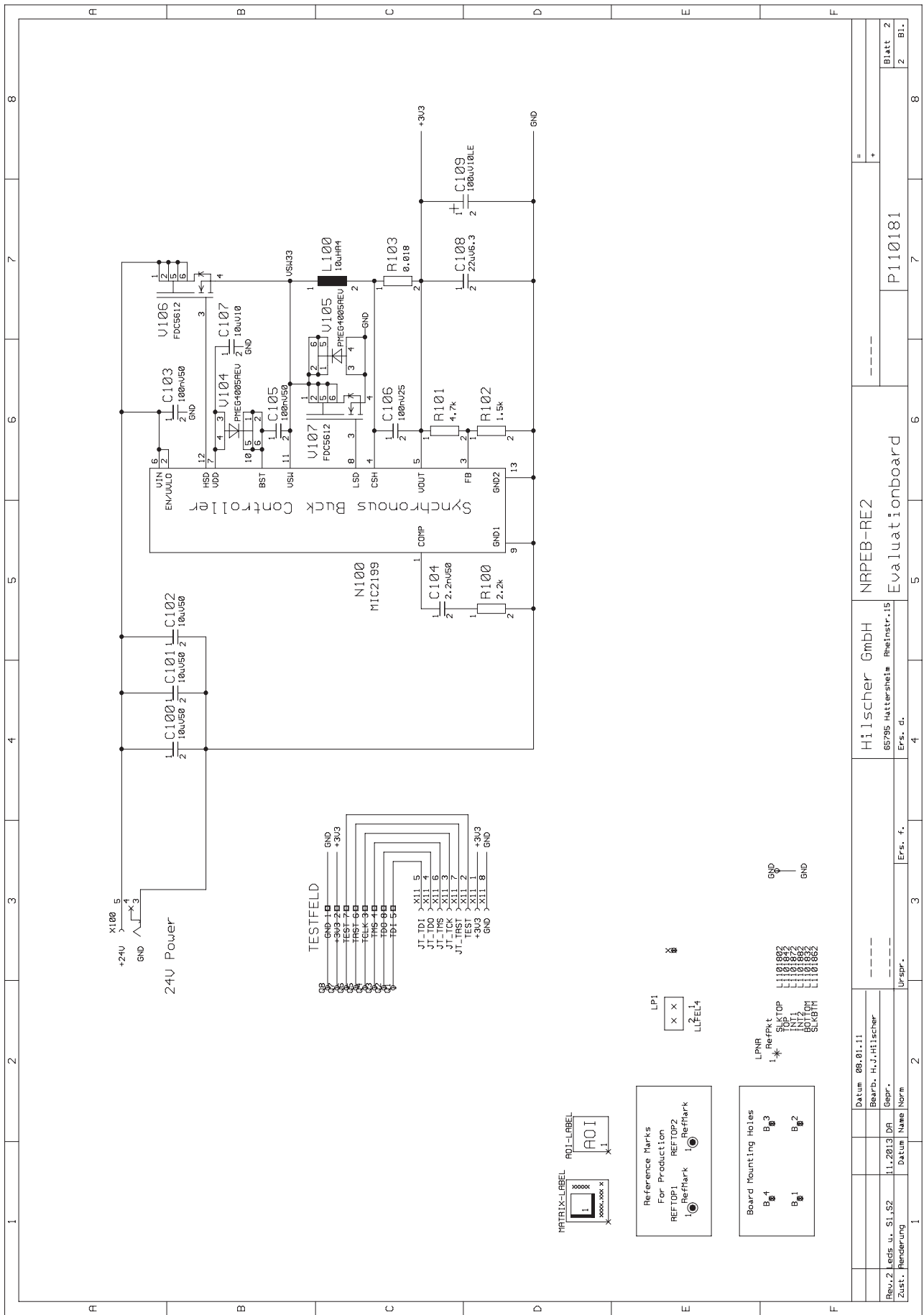


Figure 34: Schematic NRPEB 52-RE (Part 2)

10 Bill of material

10.1 Overview

The following tables contain the parts which are used on the Evaluation Boards. These tables contain the description, type and a manufacturer of the part.

10.2 NRPEB 10-CCS and NRPEB 10-DPS

Both Evaluation Boards only differ in the field bus connector and the baud rate switch: Evaluation Board NRPEB 10-CCS has X50 (CC-Link connector) and S0 (baud rate switch), while NRPEB 10-DPS has X30 (PROFIBUS connector) but no S0 (baud rate switch).

Reference	Description	#	Type (manufacturer)	Manufacturer
C5 C6 C107	Ceramic capacitor SMD0805	3	35.70.05 10uF 10V SMD0805 X5R 15%	Samsung
C100 C101 C102	Ceramic capacitor SMD1210	3	UMK325C7106KM-L 10uF 50V X7S SMD 1210	Taiyo Yuden
C103 C105	Ceramic capacitor SMD0805	2	31.65.76 100nF 50V SMD 0805 X7R 10%	Samsung
C104	Ceramic capacitor SMD0603	1	31.17.21 C0603 2200pF, 50V, X7R 10%	Samsung
C106	Ceramic capacitor SMD0603	1	32.91.65 100nF 50V SMD 0603 X7R 10%	Samsung
C108	Ceramic capacitor SMD0805	1	0805W226M6R3NT 22uF 6.3V X5R SMD0805	Novacap
D1	NRP 10-DPS or NRP 10-CCS	1	NRP 10-DPS or NRP 10-CCS	Hilscher
L100	Storage throttle SMD	1	274489169843 CDRH8D43NP-100NC	Sumida
LP1	LED light pipe 4x angled	1	1296.1004	Mentor
N100	Switching regulators step down	1	MIC2198YML-TR MIC2198YML-TR	Micrel
R1 R2 R8 R9	Resistor SMD 0603 1%	4	6900422 RC0603 FR-07 560R 1%	Yageo
R3	Resistor SMD 0603	1	31.30.66 390R, 1%, 63mW, SMD0603, TK100	Samsung
R4 R5	Resistor SMD 0603	2	31.30.41 22R, 1%, 63mW, SMD0603	Samsung
R10 R11 R12 R102	Resistor SMD 0603	4	31.30.29 1K5, 1%, 63mW, SMD0603, TK100	Samsung
R13 R15	Resistor SMD 0603	2	31.30.45 270R, 1%, 63mW, SMD0603, TK100	Samsung
R14 R16	Resistor SMD 0603	2	31.30.80 470R 63mW 1% SMD 0603, TK100	Samsung
R17 R18 R100	Resistor SMD 0603	3	34.07.40 2.2K 63mW 1% SMD 0603 TK50	Firstohm
R101	Resistor SMD 0603	1	6950011 RC0603 FR-07 4,7K 1%	Royalohm
R103	Resistor SMD 1206 1%	1	YAGRL1206FR070R018L RL 1206 FR-07 0R018L	Yageo

Reference	Description	#	Type (manufacturer)	Manufacturer
S1 S2 (NRPEB 10-DPS)	Rotary code switch BCD angled, SMD	2	COPAL Typ SA-7111TA	Copal
S0 S1 S2 (NRPEB 10-CCS)	Rotary code switch BCD angled, SMD	3	COPAL Typ SA-7111TA	Copal
T1 T2	Push button Tyco	2	FSMSMTR, 1437566-4	Tyco/AMP
V1 V11	LED yellow/green SMD	2	629885 HSMF-C166	Avago
V12 V13	LED red/green SMD	2	HSMF-C165	Avago
V3	Transient Suppressor USB port	1	229011 SN65220DBVT	Texas Instruments
V104 V105	Schottky Diode SMD	2	PMEG4005AEV,115 PMEG4005AEV,115	NXP (Philips)
V106 V107	Transistor MOSFET N channel	2	FDC5612	Fairchild
X1	Plug connector 68-pin	1	12C09-068SB SL-RM1,27-68pol.(2x34)	Haxel
X2	Multi-pin connector 2*20-pin	1	102.126.040.26	Haxel
X3	Multi-pin connector 1*10-pin	1	101.126.010.016 12.6mm	Haxel
X4	Jumper pin connector 1*4-pin	1	101.113.004.26 11.3mm	Haxel
X5	Jumper pin connector 2*3-pin	1	102.113.006.26 11.3mm	Haxel
X6	Mini-USB female 5-pin, angled SMD	1	USB MINI-B SMT MOLEX 675031020	Molex
X11	Foil connector	1	08FLZ-RSM2-TB(LF)(SN)	JST
X30 (NRPEB 10-DPS)	D-Sub socket 9-pin	1	618 009 231 321	Würth
X50 (NRPEB 10-CCS)	COMBICON 5-pin socket	1	1748222 MSTBA2,5/5-G-5,08-AU	Phoenix Contact
X50 (NRPEB 10-CCS)	COMBICON 5-pin plug	1	COMBICON 5-pin plug	Phoenix Contact
X100	Power supply chassis socket	1	Lumberg Typ 1613 13	Lumberg

Table 58: Bill of material for NRPEB 10-CCS or NRPEB 10-DPS

10.3 NRPEB 51-RE

Reference	Description	#	Type (manufacturer)	Manufacturer
C100 C101	Ceramic capacitor SMD0603	2	31.18.73 CL10B103KB8NUNC	Samsung
C102 C103 C104 C300 C301 C302 C303 C404 C405 C406 C407 C408 C409 C410 C411 C412 C414 C419 C422 C423 C505 C509	Ceramic capacitor SMD0402	22	33.88.34 GRM155R71C104KA88D	Murata Elektronik
C200 C201 C202 C203	Ceramic capacitor SMD0402	4	36.62.10 CL05B103KB5NUNC	Samsung
C204 C205	Ceramic capacitor SMD0603	2	37.71.72 CL10A106KP8NUNC	Samsung
C206 C207 C208 C209 C210 C211 C212 C213	Ceramic capacitor SMD0603	8	33.67.26 GRM188R71H104KA93D	Murata Elektronik
C214	Ceramic capacitor SMD1812	1	1812B222K202NT 2.2nF 2KV 10% SMD 1812 X7R	Novacap
C215	Ceramic capacitor SMD1210	1	KKK12486 1210AC103KAT1A	AVX
C400 C401	Ceramic capacitor SMD0603	2	30.71.56 15pF 50V SMD0603	Murata Elektronik
C402 C418	Ceramic capacitor SMD0603	2	37.71.78 22uF 6.3V X5R 20% SMD0603	Samsung
C403 C413 C415	Ceramic capacitor SMD0402	3	KKS3267 GRM155R60J106ME44D	Murata Elektronik
C420	Ceramic capacitor SMD0402	1	35.00.48 GRM1555C1H102JA01D	Murata Elektronik
C421	EEPROM ser. 2kBit 2,5-5,5V	1	M93C56-WMN6P M93C56- WMN6P	ST Microelectronics
C504	Ceramic capacitor SMD0603	1	40.72.08 MLCC 0603 (1,6 x 0,8 x 0,8mm) 1,5 nF 50V X7R ±10%	Samsung
C506	Ceramic capacitor SMD0603	1	31.17.18 18PF 50V SMD 0603 C0G 5%	Samsung
C508	Ceramic capacitor SMD 1210	1	81-GRM32EC70J107ME5L GRM32EC70J107ME15L	Murata Elektronik
C510 C511	Ceramic capacitor SMD1210	2	UMK325C7106KM-L 10uF 50V X7S SMD 1210	Taiyo Yuden
C512	Ceramic capacitor SMD1210	1	35.83.69 GRM32ER72A225KA35L	Murata Elektronik
G400	Quartz 12MHz SMD	1	231717 Q 12,0-JXS32-12-30/50- T1-LF	Jauch
K100 K102	Buffer 1* S.T.	2	74LVC1G17GW,125	NXP, Phillips (ab 2017 Qualcomm)

Reference	Description	#	Type (manufacturer)	Manufacturer
K101	AND 1*2E	1	NC7SZ08P5X	Fairchild
K200	NRP 51-RE\F8T	1	NRP 51-RE	Hilscher GmbH
K300 K301 K302 K303	MULTI/DEMULTIPLEXER 2:1, 4X	4	959-0862 SN74CBTLV3257PW	Texas Instruments
K400	Dual High Speed USB to Multipurpose	1	FT2232HQ	Future Technology Devices Int.
K500	Diode SMD	1	DLGL5489 SM4004 PBF MELF	Diotec Semiconductor
P200 P203	LED yellow/green SMD	2	HSMF-C166	Avago (Broadcom)
P201 P202 P500	LED red/green SMD	3	HSMF-C165	Avago (Broadcom)
Q400	Voltage supervision 3V	1	576-3808-6-ND MIC803-30D2VM3-TR	Micrel (now Microchip)
R137 R413	Resistor SMD 0402	2	47.87.92 RC0402FR-071KL	Yageo
R138 R216 R217	Resistor SMD 0603	3	47.96.40 RC0603FR-0722RL	Yageo
R139 R140 R200 R201 R222 R223 R224 R225 R226 R227 R228 R229 R300 R301 R402 R403 R407	Resistor SMD 0402	17	RC1005F103AS (40K Rolle)	Samsung
R202 R203 R204 R205 R206 R207 R208 R209 R240 R241 R411	Resistor SMD 0402	11	47.89.21 RC0402FR-072K2L	Yageo
R212 R213 R214 R215	Resistor SMD 0603 1%	4	47.94.36 RC0603FR-0710RL	Yageo
R218 R219 R242 R243	Resistor SMD 0402	4	47.91.14 RC0402FR-07560RL	Yageo
R220	Resistor SMD 0402	1	47.88.65 RC0402FR-07220RL	Yageo
R221	TVS-Diode, USB-Port	1	SN65220DBVRG4	Texas Instruments
R230 R231 R232 R233 R234 R235	Resistor SMD 0402	6	47.89.02 RC0402FR-07270RL	Yageo
R236 R237	Resistor SMD 0402	2	47.90.68 RC0402FR-07470RL	Yageo
R238 R239	Resistor SMD 0402	2	47.88.07 RC0402FR-071K5L	Yageo
R244	Resistor SMD 1206	1	48.12.73 RC1206FR-071ML	Yageo

Reference	Description	#	Type (manufacturer)	Manufacturer
R400	Resistor SMD 0603	1	31.30.09 12K, 1%, 100mW, SMD0603	Samsung
R401 R404	Ferrite suppressor choke. SMD0805	2	742 792 040 600 Ohm, 2A, SMD0805, RoHS	Würth
R405 R406 R412	Resistor SMD 0402 1%	3	47.86.89 RC0402FR-0710RL	Yageo
R410	ESD Array 3 Channel SOT-5	1	296-21885-6-ND TPD3E001DRLR	Texas Instruments
R500	Varistor SMD	1	B72580E0300K062	Epcos
R501	Storage choke SMD	1	744 071 150 Würth ind. 15uH, 2.3A, 0.055Ohm	Würth
R502	Resistor SMD 0603	1	31.30.20 180K, 1%, 63mW, SMD0603	Samsung
R503	Resistor SMD 0402	1	31.44.02 CRCW040220K0FKED	VISHAY
R504	Schottky Diode	1	DSKYS4888 SS26-E3/52T	VISHAY
R505	Resistor SMD 0402	1	36.88.62 RC0402FR-074K7L	Yageo
R506	Resistor SMD 0603	1	47.95.64 RC0603FR-071K5L	Yageo
R507	Resistor SMD 0603 1%	1	4224528 RESISTOR, SMD 49K9	Multicomp
R508	Resistor SMD 0603 1%	1	47.96.74 RC0603FR-07270KL	Yageo
R509	TVS-Diode, single bidir.	1	STMSM15T36CA SM15T36CA	ST Microelectronics
R510	Suppressor choke SMD	1	B82442T1473K050	Epcos
R511	Resistor SMD 0603	1	47.96.75 RC0603FR-07270RL	Yageo
S100 S200	Pushbutton Tyco	2	FSMSMTR, 1437566-4	Tyco/AMP
S201 S202	Rotary switch BCD angled, SMD	2	70110343 COPAL Typ SA-7111TA	Copal
T400	DC/DC Converter SMD	1	EN5311QI-T	Enpirion (Altera)
T500	DC/DC-Switching regulator	1	TPS54360DDAR TPS54360DDAR	Texas Instruments
X201	Foil connector	1	08FLZ-RSM2-TB(LF)(SN)	JST
S203 S204 S300 S301	Slide switch, Mini, On-On	4	450301014042 Schiebeschalter, Mini, On-On	Würth
X104	Plug connector 68-pin	1	12C09-068SB SL-RM1,27-68pol.(2x34)	FJH Steckerverbindung GmbH
X105	Pin header 2*20pin.	1	102.126.040.26	FJH Steckerverbindung GmbH
X200	MiniUSB-socket 5 pin. angled wired	1	054819-0519 Molex 0548190519	Molex

Reference	Description	#	Type (manufacturer)	Manufacturer
X202	Jumper pin connector 1*4pin.	1	101.113.004.26 11.3mm	FJH Steckerverbindun g GmbH
X203	RJ45-2X1-90°-D-E-I100-G-Y-T-C	1	J8064D628ANL, PULSE	Pulse
X300	Jumper pin connector 2*6pin.	1	102.113.012.26 11.3mm	FJH Steckerverbindun g GmbH
X400	USB-Socket 4pin Type B angled	1	KUSBX-BS-1-N-B	Kycon
X511	Power supply chassis socket	1	CP-014C-ND CONN POWER JACK 1MM; PJ-014C	CUI INC.

Table 59: Bill of material for NRPEB 51-RE

10.4 NRPEB 52-RE

Reference	Description	#	Type (manufacturer)	Manufacturer
C1	Ceramic capacitor SMD1808	1	1808J2K00222KXT 2.2nF 2KV 10% SMD 1808 X7R	Syfer
C5 C6 C107	Ceramic capacitor SMD0805	3	35.70.05 10uF 10V SMD0805 X5R 15%	Samsung
C100 C101 C102	Ceramic capacitor SMD1210	3	UMK325C7106KM-L 10uF 50V X7S SMD 1210	Taiyo Yuden
C103 C105	Ceramic capacitor SMD0805	2	31.65.76 100nF 50V SMD 0805 X7R 10%	Samsung
C104	Ceramic capacitor SMD0603	1	31.17.21 C0603 2200pF, 50V, X7R 10%	Samsung
C106	Ceramic capacitor SMD0603	1	32.91.65 100nF 50V SMD 0603 X7R 10%	Samsung
C108	Ceramic capacitor SMD0805	1	0805W226M6R3NT 22uF 6.3V X5R SMD0805	Novacap
C109	Tantalum capacitor SMD_D Low ESR	1	T495D107K010ATE100 100uF 10V SMD_D Low ESR	Kemet
D1	NRP 52-RE	1	NRP 52-RE	Hilscher
L100	Storage throttle SMD	1	274489169843 CDRH8D43NP-100NC	Sumida
LP1	LED light pipe 4x angled	1	1296.1004	Mentor
N100	Switching regulators step down	1	MIC2199YML TR	Micrel
R1 R2 R8 R9	Resistor SMD 0603 1%	4	6900422 RC0603 FR-07 560R 1%	Yageo
R3	Resistor SMD 0603	1	31.30.66 390R, 1%, 63mW, SMD0603, TK100	Samsung
R4 R5	Resistor SMD 0603	2	31.30.41 22R, 1%, 63mW, SMD0603	Samsung
R6	Resistors network SMD	1	CAY16-750 J4 LF 75R 5% SMD1206	Bourns
R11 R12 R102	Resistor SMD 0603	3	31.30.29 1K5, 1%, 63mW, SMD0603, TK100	Samsung
R13 R15	Resistor SMD 0603	2	31.30.45 270R, 1%, 63mW, SMD0603, TK100	Samsung
R14 R16	Resistor SMD 0603	2	31.30.80 470R 63mW 1% SMD 0603, TK100	Samsung
R17 R18 R100	Resistor SMD 0603	3	34.07.40 2.2K 63mW 1% SMD 0603 TK50	Firstohm
R101	Resistor SMD 0603	1	6950011 RC0603 FR-07 4,7K 1%	Royalohm
R103	Resistor SMD 1206 1%	1	YAGRL1206FR070R018L RL 1206 FR-07 0R018L	Yageo
S1 S2	Rotary code switch BCD angled, SMD	2	COPAL Typ SA-7111TA	Copal
T1 T2	Push button Tyco	2	FSMSMTR, 1437566-4	Tyco/AMP
V1 V11	LED yellow/green SMD	2	629885 HSMF-C166	Avago
V12 V13	LED red/green SMD	2	HSMF-C165	Avago
V3	Transient suppressor USB port	1	229011 SN65220DBVT	Texas Instruments
V104 V105	Schottky Diode SMD	2	PMEG4005AEV,115 PMEG4005AEV,115	NXP (Philips)
V106 V107	Transistor MOSFET N channel	2	FDC5612	Fairchild
X1	Plug connector 68-pin	1	12C09-068SB SL-RM1,27-68pol.(2x34)	Haxel
X2	Multi-pin connector 2*20-pin	1	102.126.040.26	Haxel
X4	Jumper pin connector 1*4-pin	1	101.113.004.26 11.3mm	Haxel
X5	Jumper pin connector 2*3-pin	1	102.113.006.26 11.3mm	Haxel

Reference	Description	#	Type (manufacturer)	Manufacturer
X6	Mini-USB female 5-pin, angled SMD	1	USB MINI-B SMT MOLEX 675031020	Molex
X11	Foil connector	1	08FLZ-RSM2-TB(LF)(SN)	JST
X50	RJ45 socket 8-pin 2-ports shielded 2xLED	1	278406 RJHSE-5381-02	Amphenol
X100	Power supply chassis socket	1	Lumberg Typ 1613 13	Lumberg

Table 60: Bill of material for NRPEB 52-RE

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11.3 Legal notes

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We reserve the right to modify our products and the specifications for such as well as the corresponding documentation in the form of a user's manual, operating manual and/or any other document types and accompanying texts at any time and without notice without being required to notify of said modification. Changes shall be taken into account in future manuals and do not represent an obligation of any kind, in particular there shall be no right to have delivered documents revised. The manual delivered with the product shall apply.

Under no circumstances shall Hilscher Gesellschaft für Systemautomation mbH be liable for direct, indirect, ancillary or subsequent damage, or for any loss of income, which may arise after use of the information contained herein.

Liability disclaimer

The hardware and/or software was created and tested by Hilscher Gesellschaft für Systemautomation mbH with utmost care and is made available as is. No warranty can be assumed for the performance or flawlessness of the hardware and/or software under all application conditions and scenarios and the work results achieved by the user when using the hardware and/or software. Liability for any damage that may have occurred as a result of using the hardware and/or software or the corresponding documents shall be limited to an event involving willful intent or a grossly negligent violation of a fundamental contractual obligation. However, the right to assert damages due to a violation of a fundamental contractual obligation shall be limited to contract-typical foreseeable damage.

It is hereby expressly agreed upon in particular that any use or utilization of the hardware and/or software in connection with

- Flight control systems in aviation and aerospace;
- Nuclear fission processes in nuclear power plants;
- Medical devices used for life support and
- Vehicle control systems used in passenger transport

shall be excluded. Use of the hardware and/or software in any of the following areas is strictly prohibited:

- For military purposes or in weaponry;
- For designing, engineering, maintaining or operating nuclear systems;
- In flight safety systems, aviation and flight telecommunications systems;
- In life-support systems;
- In systems in which any malfunction in the hardware and/or software may result in physical injuries or fatalities.

You are hereby made aware that the hardware and/or software was not created for use in hazardous environments, which require fail-safe control mechanisms. Use of the hardware and/or software in this kind of environment shall be at your own risk; any liability for damage or loss due to impermissible use shall be excluded.

Warranty

Hilscher Gesellschaft für Systemautomation mbH hereby guarantees that the software shall run without errors in accordance with the requirements listed in the specifications and that there were no defects on the date of acceptance. The warranty period shall be 12 months commencing as of the date of acceptance or purchase (with express declaration or implied, by customer's conclusive behavior, e.g. putting into operation permanently).

The warranty obligation for equipment (hardware) we produce is 36 months, calculated as of the date of delivery ex works. The aforementioned provisions shall not apply if longer warranty periods are mandatory by law pursuant to Section 438 (1.2) BGB, Section 479 (1) BGB and Section 634a (1) BGB [Bürgerliches Gesetzbuch; German Civil Code] If, despite of all due care taken, the delivered product should have a defect, which already existed at the time of the transfer of risk, it shall be at our discretion to either repair the product or to deliver a replacement product, subject to timely notification of defect.

The warranty obligation shall not apply if the notification of defect is not asserted promptly, if the purchaser or third party has tampered with the products, if the defect is the result of natural wear, was caused by unfavorable operating conditions or is due to violations against our operating regulations or against rules of good electrical engineering practice, or if our request to return the defective object is not promptly complied with.

Costs of support, maintenance, customization and product care

Please be advised that any subsequent improvement shall only be free of charge if a defect is found. Any form of technical support, maintenance and customization is not a warranty service, but instead shall be charged extra.

Additional guarantees

Although the hardware and software was developed and tested in-depth with greatest care, Hilscher Gesellschaft für Systemautomation mbH shall not assume any guarantee for the suitability thereof for any purpose that was not confirmed in writing. No guarantee can be granted whereby the hardware and software satisfies your requirements, or the use of the hardware and/or software is uninterrupted or the hardware and/or software is fault-free.

It cannot be guaranteed that patents and/or ownership privileges have not been infringed upon or violated or that the products are free from third-party influence. No additional guarantees or promises shall be made as to whether the product is market current, free from deficiency in title, or can be integrated or is usable for specific purposes, unless such guarantees or promises are required under existing law and cannot be restricted.

Confidentiality

The customer hereby expressly acknowledges that this document contains trade secrets, information protected by copyright and other patent and ownership privileges as well as any related rights of Hilscher Gesellschaft für Systemautomation mbH. The customer agrees to treat as confidential all of the information made available to customer by Hilscher Gesellschaft für Systemautomation mbH and rights, which were disclosed by Hilscher Gesellschaft für Systemautomation mbH and that were made accessible as well as the terms and conditions of this agreement itself.

The parties hereby agree to one another that the information that each party receives from the other party respectively is and shall remain the intellectual property of said other party, unless provided for otherwise in a contractual agreement.

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The delivered product (including technical data) is subject to the legal export and/or import laws as well as any associated regulations of various countries, especially such laws applicable in Germany and in the United States. The products / hardware / software must not be exported into such countries for which export is prohibited under US American export control laws and its supplementary provisions. You hereby agree to strictly follow the regulations and to yourself be responsible for observing them. You are hereby made aware that you may be required to obtain governmental approval to export, reexport or import the product.

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