Hardware Documentation

PicoCoreBBRGB

Version 003
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Preliminary

This document is subject to change without notice

Elektronik Systeme

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About This Document

This document describes how to use the PicoCore™ start interface board with mechanical and electrical information. The latest version of this document can be found at:

http://www.fs-net.de.

History

Date	V	Platform	A,M,R	Chapter	Description	Au
22.01.2019	001	All		-	Initial Version	TM
03.04.2019	002	All	M	4.5, 4.10	Update to PCB Rev 1.30	TM
13.11.2019	003	All	M	4.10	Added notice for rev 1.20	HF
13.11.2019	003	All	M	5	Added connector info	HF

V	Version
A,M,R	Added, Modified, Removed
Au	Author

Table of Contents

1 Main Features

1.1 Interfaces

The following table shows the maximum possible number of each interface. Not all interfaces are available at the same time and depends on the appropriate assembly variant.

Features	Description
SD Card	1x micro SD
Ethernet	2x 1Gb
USB Host	2x
USB Device	1x
CAN	1x
UART	3x RS232
I2C	2x
Audio	HP / MIC
LCD	1x 24 bit

Table 1: Main Features

2 Mechanical Dimension

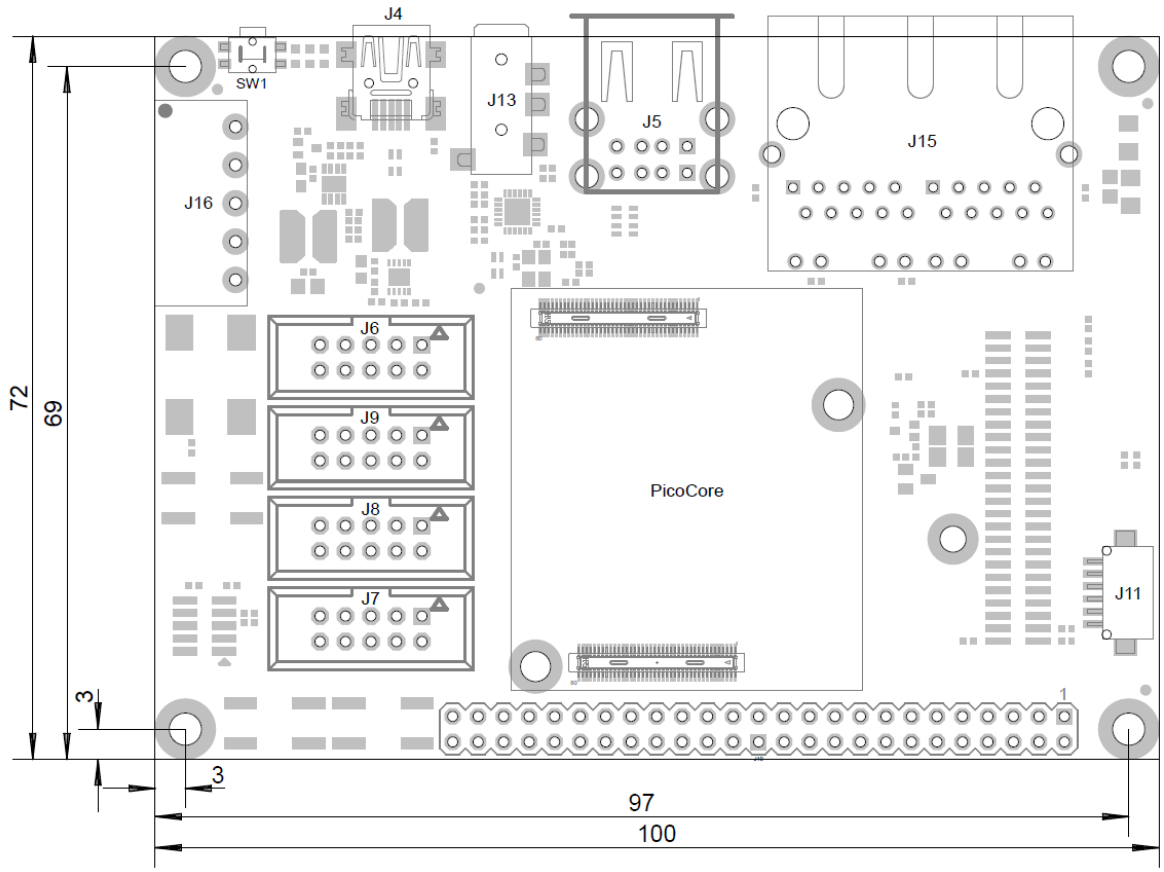

Figure 1: Mechanical Dimensions in mm

Size:	100mm x 72mm
PCB thickness:	1.5 ± 0.1mm
Height of the parts on the top side:	16mm
Height of the parts on the bottom side:	3mm
Weight:	57,25g

3 Connector Layout

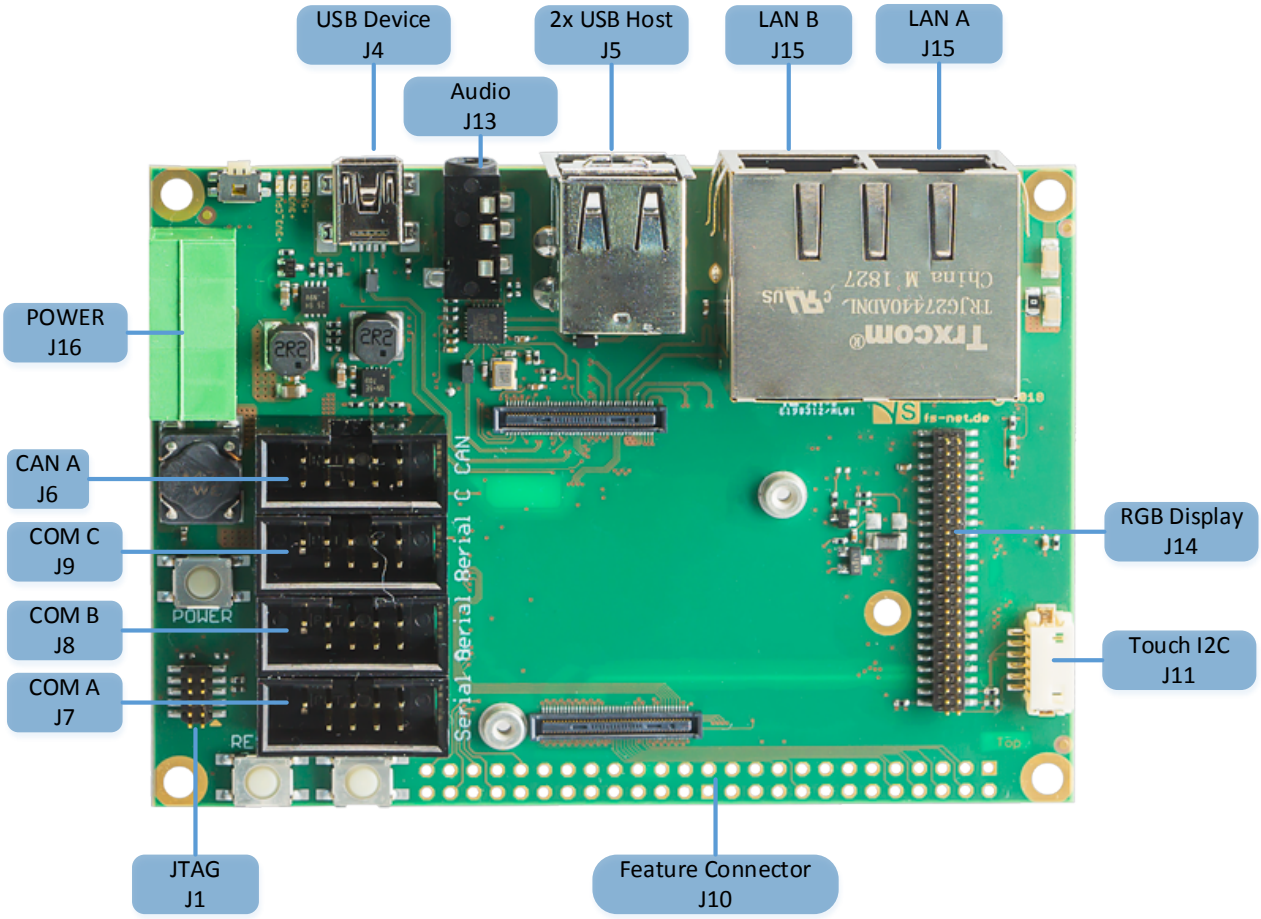

Figure 2: Connector Layout

Ref.	Description	Remarks
J1	JTAG Connector	Top side, 10 pins
J4	USB-Device Connector	
J5	USB-Host, Stacked USB Type-A Connector	
J6	CAN	
J7	UART_A (Debug Port), RS232 only RXD and TXD	
J8	UART_B, RS232 only RXD and TXD	
J9	UART_C, RS232 with RXD, TXD, RTS and CTS	
J10	GPIO Feature Connector	Top side, 50 pins
J11	I2C	
J13	Audio, Headphone and MIC	
J15	Ethernet, 2xRJ45 With Integrated Magnetics	
J16	Power Connector	

Table 2: Connectors & Switches List

4 Interface and Signal Description

4.1 PicoCore Connectors (J1, J2)

Type: DF40C-80DS-0.4V(51)

Manufacturer: Hirose

Please refer the PicoCore module datasheet for pin-out assignments.

4.2 J16 - Power Supply Connector

The PicoCore base board has a 5 way connector with 3,81mm pitch for an external DC power supply. The position and pin-out of the power connector is compatible to F&S 24V power supply.

Connector Base Board: Phoenix Contact (MC 1,5/ 5-G-3,81)

Matching Connector: Phoenix Contact (MC 1,5/ 5-ST-3,81)

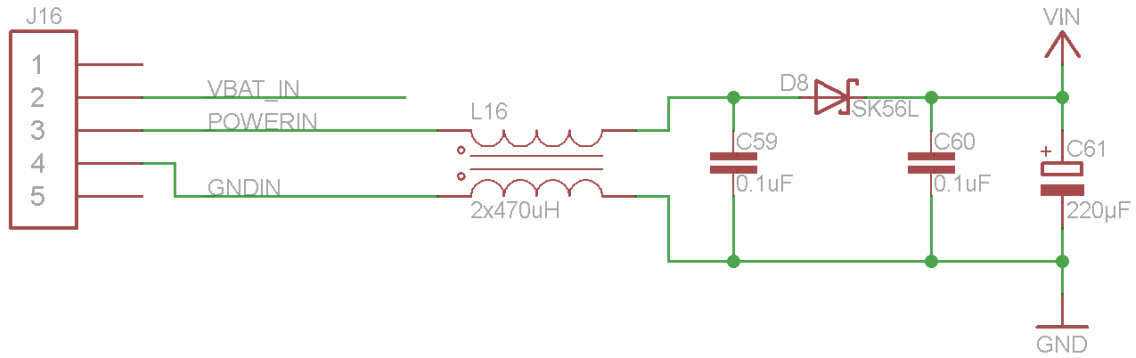

Figure 3: Power Supply

J16 Pin	J24 Name	I/O	Remarks
1	NC		
2	VBAT_IN	PWR	Voltage: 0,9V-5,5V
3	POWERIN	PWR	Voltage: 3,8V-5,5V
4	GNDIN	PWR	
5	NC		

Table 3: Power Connector Pin Layout

4.3 J6 – CAN Interface

The board offers 1 CAN port with transceiver. The 120 Ohm termination is set per default. The CAN port (CAN_A) is connected to a standard 10 pin header (J6), to connect a free hanging IDC DSUB-9 connector. Pin 1 is marked on the connector with an arrow.

J6 Pin	Signal Name	I/O Type	Voltage	Remarks
1	VCC_COM	PWR	+5V	
2	GND	GND	GND	
3	CAN_A_L			
4	CAN_A_H			
5	GND	GND	GND	
6	N.C.			
7	N.C.			
8	VCC_COM	PWR	+5V	
9	N.C.			
10	N.C.			

Table 4: CAN Interface

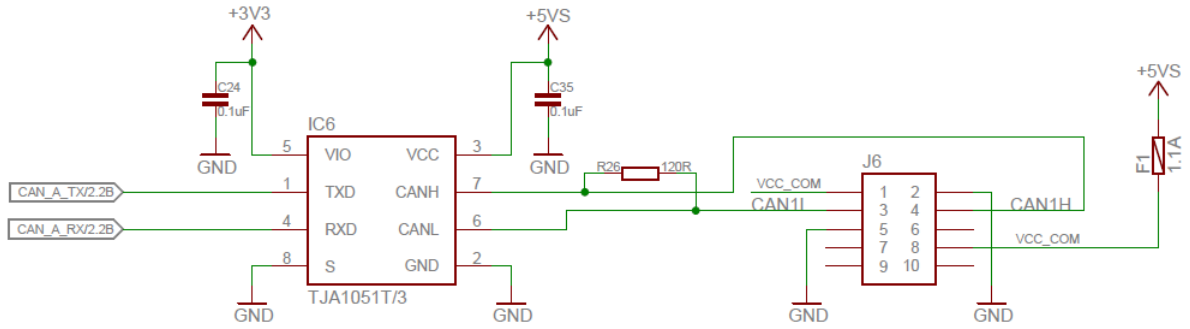

Figure 4: CAN Transceiver Schematic

4.4 COM ports

The carrier board offers four COM ports (A-D).
Port A, B and C are RS232 and port D is TTL only.

4.4.1 J7/J8 - COM A/B Interface

The first two ports are RS232 ports without RTS/CTS. Whereas COM A (J7) is typically used as Debug-port. The COM connector is a standard 2.54 mm 10 pin header to connect a free hanging IDC DSUB-9 connector. Pin 1 is marked on the connector with an arrow.

J7 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	N.C.				
2	N.C.				
3	RX_A	J1/6			
4	N.C.				
5	TX_A	J1/8			
6	N.C.				
7	N.C.				
8	N.C.				
9	VCC_COM		PWR	+5V	
10	GND		GND	GND	

Table 5: UART A Interface

J8 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	N.C.				
2	N.C.				
3	RX_B	J1/5			
4	N.C.				
5	TX_B	J1/7			
6	N.C.				
7	N.C.				
8	N.C.				
9	VCC_COM		PWR	+5V	
10	GND		GND	GND	

Table 6: UART B Interface

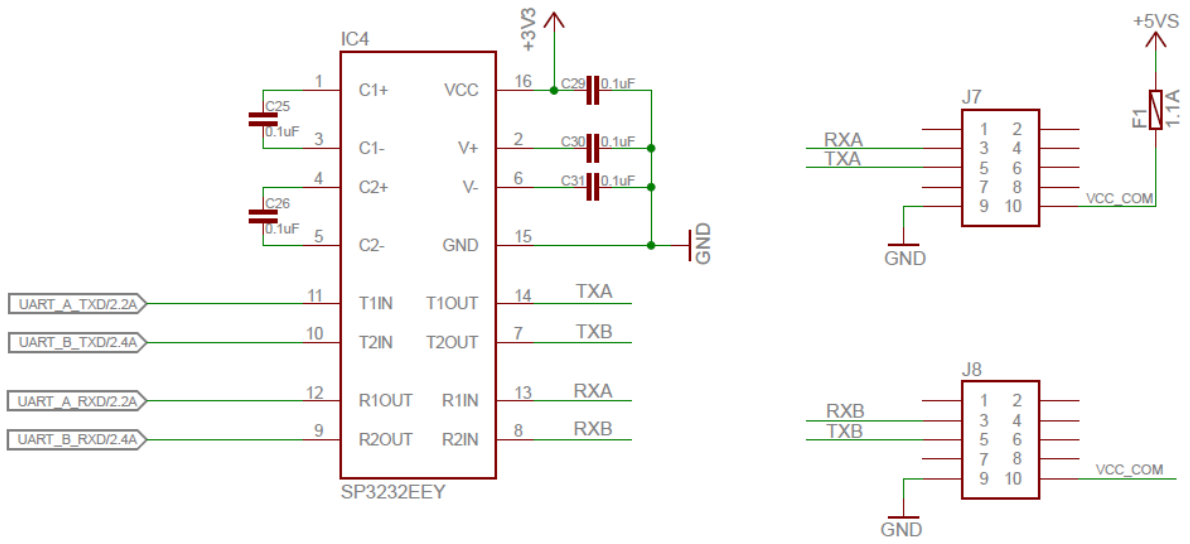

Figure 5: COM A/B schematic

4.4.2 J9 - COM C Interface

This port is a RS232 port with RTS/CTS signals. The COM connector is a 2.54 mm standard 10 pin header to connect a free hanging IDC DSUB-9 connector. Pin 1 is marked on the connector with an arrow.

J8 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	N.C.				
2	N.C.				
3	RXD_C_RS232	J1/13			
4	RTS_C_RS232	J1/11			
5	TXD_C_RS232	J1/15			
6	CTS_C_RS232	J1/9			
7	N.C.				
8	N.C.				
9	VCC_COM		PWR	+5V	
10	GND		GND	GND	

Table 7: UART C Interface

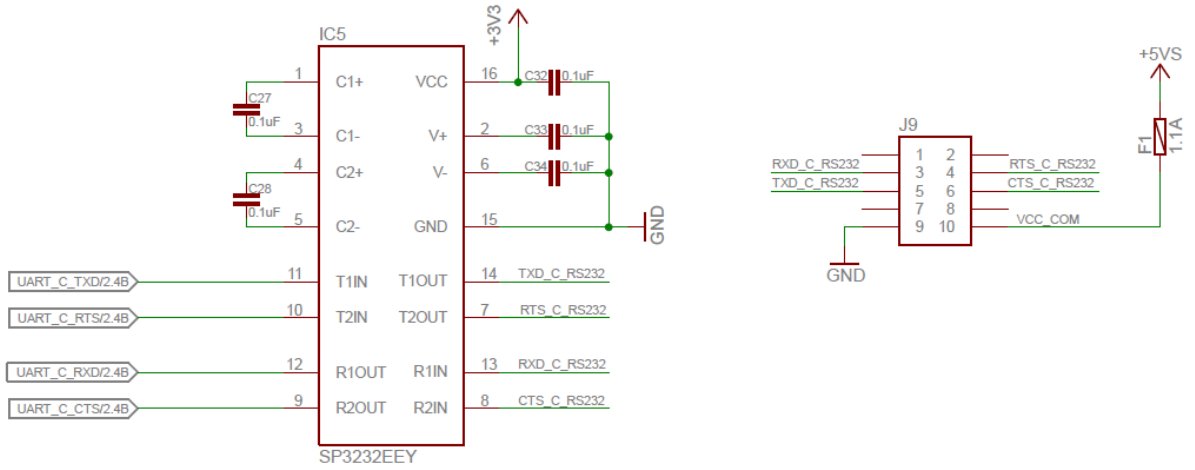

Figure 6: COM C schematic

4.4.3 J10 - COM D Interface

Port D is only 3,3V TTL level. Means the pins are directly connected to the PicoCore module.

J10 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
13	UART_D_TXD	J1/19	I/Odiff	3.3V	
15	UART_D_RXD	J1/17			

Table 8: UART D Interface

4.5 Ethernet Interface

The PicoCore base board provides two GBit RJ-45 connectors with integrated magnetics. The maximum transmission speed depends on the PicoCore module. All signals are routed with an impedance of 100Ω ±10% and a maximum length difference between pairs of 0.2mm.

4.5.1 J15L - LAN A

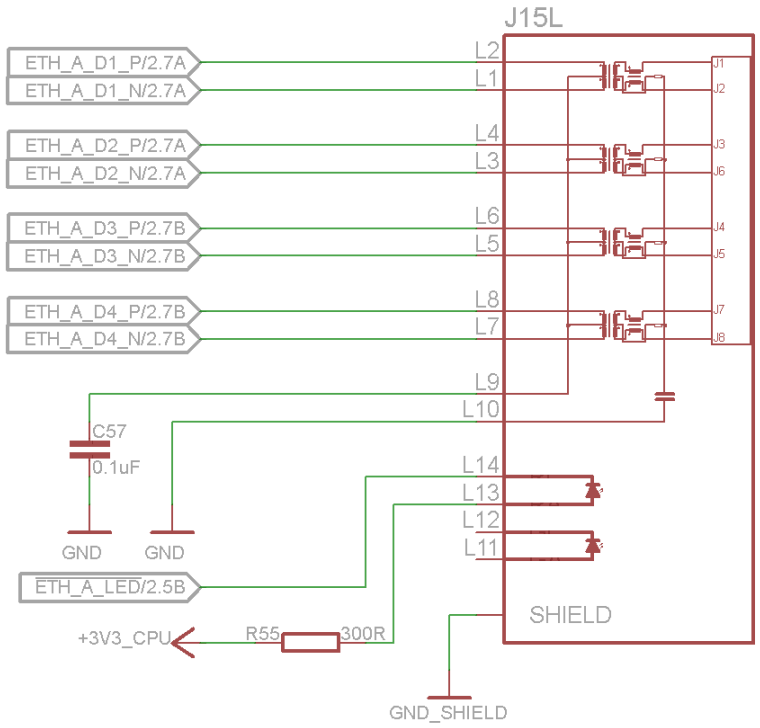

Figure 7: J15L LAN A Schematic

Connector type: 2x RJ-45, Trxcom TRJG27440ADNL

J15L Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	ETH_A_D1_N	J2-3	I/Odiff	3.3V	Differential data line routed with 100Ω
2	ETH_A_D1_P	J2-1			
3	ETH_A_D2_N	J2-7	I/Odiff	3.3V	Differential data line routed with 100Ω
4	ETH_A_D2_P	J2-5			
5	ETH_A_D3_N	J2-11	I/Odiff	3.3V	Differential data line routed with 100Ω
6	ETH_A_D3_P	J2-9			
7	ETH_A_D4_N	J2-15	I/Odiff	3.3V	Differential data line routed with 100Ω
8	ETH_A_D4_P	J2-13			
9					
10					
11	ETH_A_LED	J2-14	O	3.3V	
12	+3V3_CPU	J2-52	PWR	3.3V	300Ω serial resistor
13	NC				
14	NC				

Table 9: LAN A Interface

4.5.2 J15R - LAN B

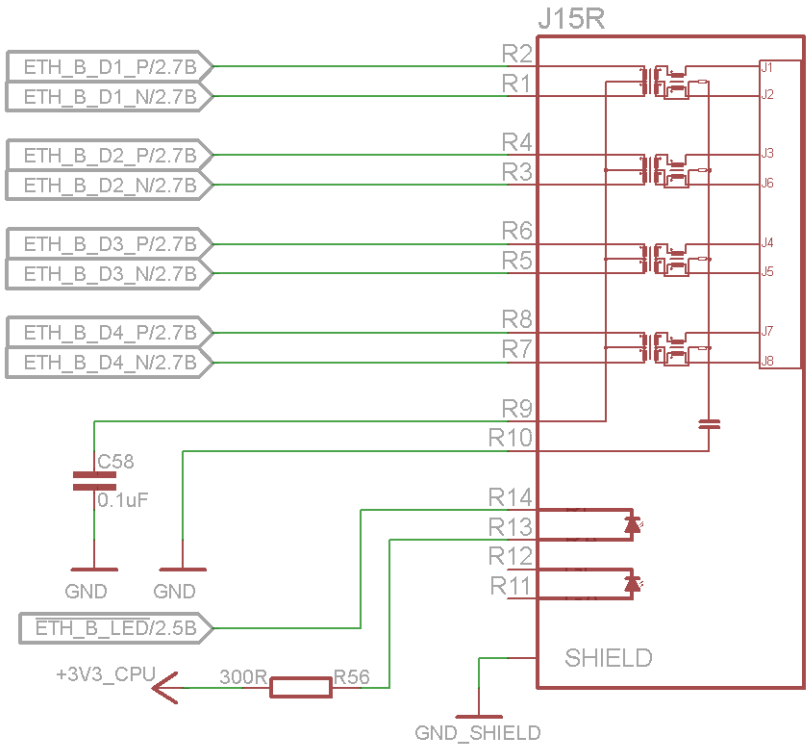

Figure 8: J15R LAN B

Connector type: 2x RJ-45, Trxcom TRJG27440ADNL

J15R Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	ETH_B_D1_N	J2-21	I/Odiff	3.3V	Differential data line routed with 100Ω
2	ETH_B_D1_P	J2-19			
3	ETH_B_D2_N	J2-25	I/Odiff	3.3V	Differential data line routed with 100Ω
4	ETH_B_D2_P	J2-23			
5	ETH_B_D3_N	J2-29	I/Odiff	3.3V	Differential data line routed with 100Ω
6	ETH_B_D3_P	J2-27			
7	ETH_B_D4_N	J2-33	I/Odiff	3.3V	Differential data line routed with 100Ω
8	ETH_B_D4_P	J2-31			
9					
10					
11	ETH_B_LED	J2-16	O	3.3V	
12	+3V3_CPU	J2-52	PWR	3.3V	Connected via 300Ω serial resistor to +3V3_CPU
13	NC				
14	NC				

Table 10: LAN B Interface

4.6 Micro SD Card Interface

The carrier board provides a Push-Pull micro SD Card connector. The SD Card voltage of the PicoCore module is generated on the carrier board. The SD Card interface can operate with 3.3V and 1.8V. The voltage is controlled with the SD_A_VSEL signal. All Pull-Ups on the SD Card signals must be connected to SD_A_VCC.

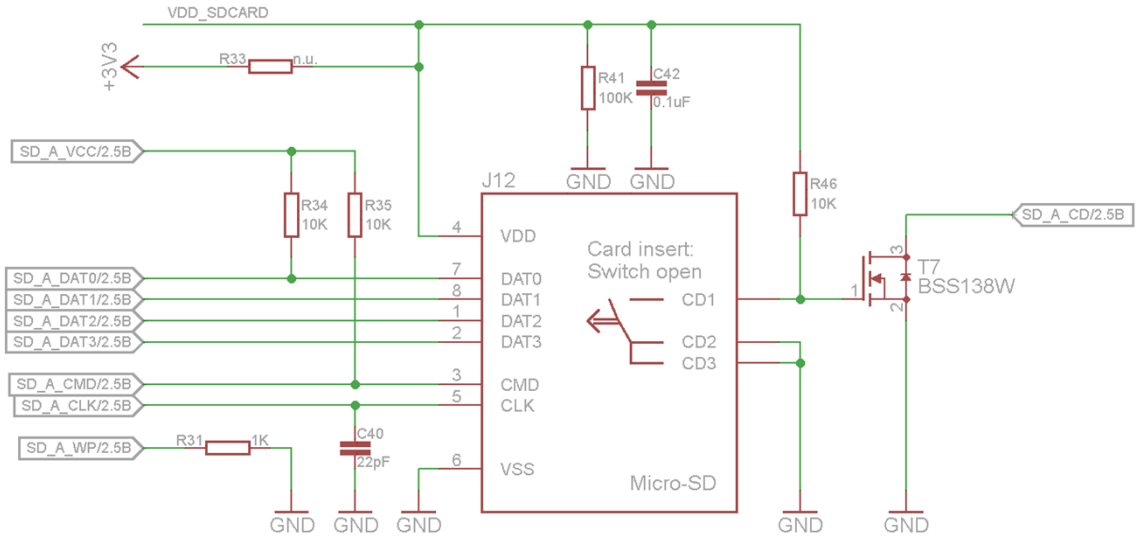

Figure 9: SD Card Schematic

J12 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	SD_A_DAT2	J2-44	I/O	3.3V / 1.8V	
2	SD_A_DAT3	J2-46	I/O	3.3V / 1.8V	
3	SD_A_CMD	J2-36	I/O	3.3V / 1.8V	
4	SD_A_VCC	J2-26	PWR	3.3V / 1.8V	
5	SD_A_CLK	J2-38	O	3.3V / 1.8V	
6	GND		PWR	3.3V / 1.8V	
7	SD_A_DAT0	J2-40	I/O	3.3V / 1.8V	
8	SD_A_DAT1	J2-42	I/O	3.3V / 1.8V	
CD1	SD_A_CD	J2-34	O	3.3V / 1.8V	

Table 11: SDIO Interface

4.6.1 SD Card Power

The SD Card voltage level is controlled with the SD_A_VSEL signal. If this signal is high the voltage for the SD Card is 3.3V. Otherwise the voltage level is 1.8V. This voltage is also the supply for the SDIO controller of the PicoCore module. If this feature is not required you have to connect the SD_A_VCC to the 3.3V of the base board.

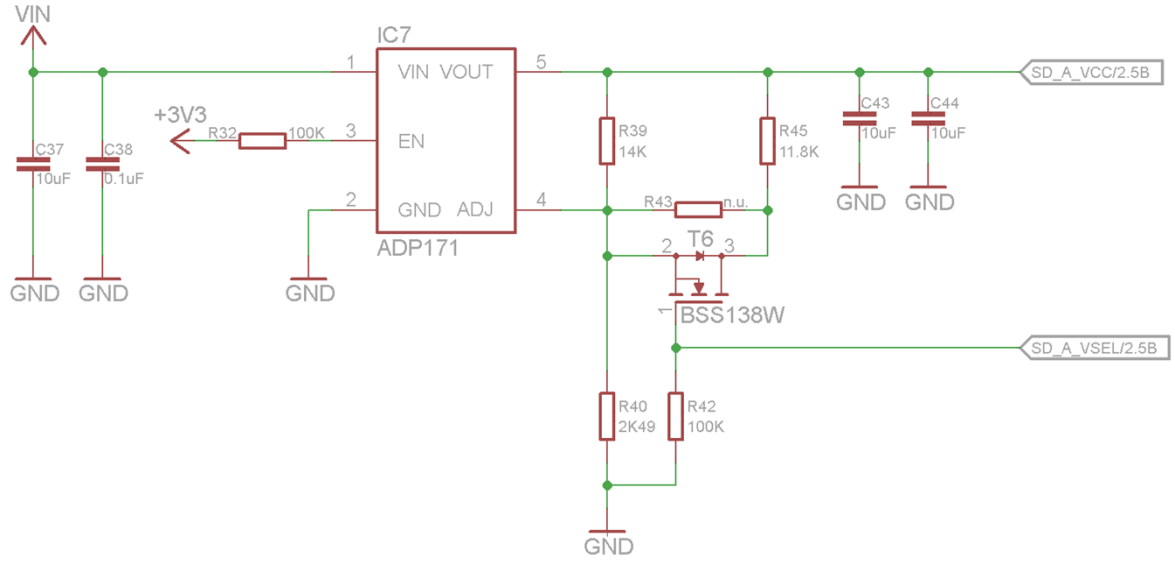

Figure 10: SD Card Voltage Supply Schematic

4.7 J4 - USB OTG

The USB OTG port can operate as device or as a host port. To control the USB_VBUS is only necessary if this feature is needed. In device only mode this part is not needed. The USB differential signals are routed with an impedance of 90Ω.

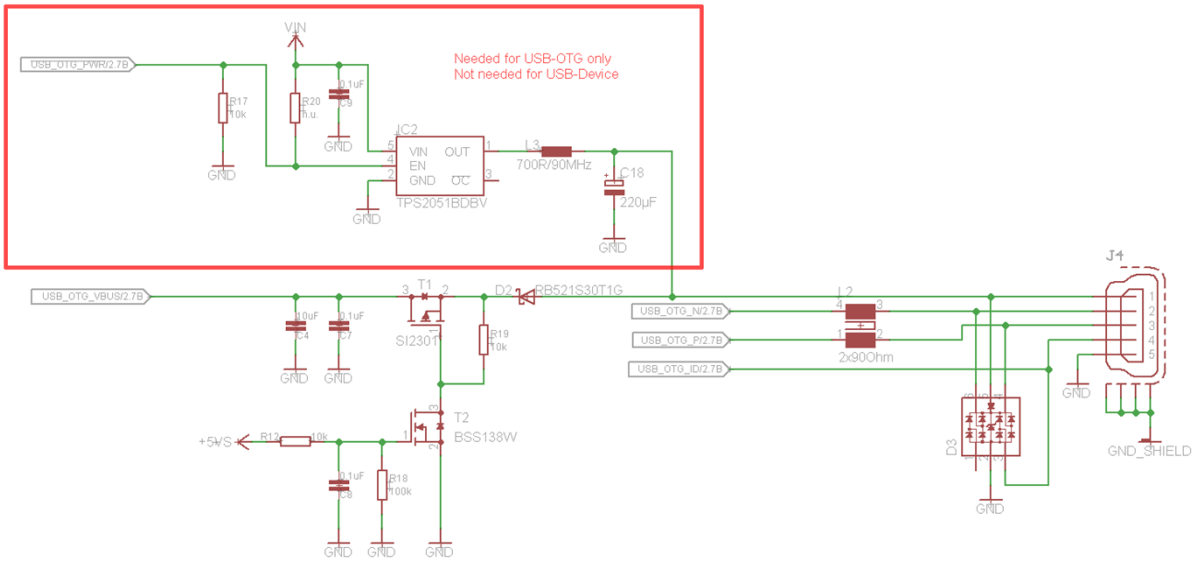

Figure 11: USB-OTG

Connector type: Würth Elektronik eiSos 651 005 161 21

J4 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	USB_OTG_VBUS	J2-37	PWR	5V	Input in device mode and output in host mode
2	USB_OTG_N	J2-45	I/Odiff	5V	Differential data line routed with 90Ω
3	USB_OTG_P	J2-43			
4	USB_OTG_ID	J2-41	I	5V	
5	GND		PWR	GND	

Table 12: USB OTG Interface Pin Layout

4.8 J5 - USB Host

All USB ports follow the USB 2.0 specification.

With a Hub, the single USB-Port of the PicoCore module is expanded to two USB Ports (A/B).

Port A (top) and port B (bottom) are connected to the USB Host front connector.

The 90 Ohm differential pair of USB signals doesn't need any termination. For external ports, EMV protection is required nearby the USB connector.

The usb.org webpage provides "High Speed USB Platform Design Guidelines" with highly recommended information for a proper working USB design.

J5 Pin	Signal Name	I/O Type	Voltage	Remarks
T1	USB_PWR_A*	PWR	+5V	Input in device mode and output in host mode
T2	USB_DN_A	I/Odiff	5V	Differential data line routed with 90Ω
T3	USB_DP_A			
T4	GND		GND	
B1	USB_PWR_B*	PWR	+5V	
B2	USB_DN_B	I/Odiff	5V	Differential data line routed with 90Ω
B3	USB_DP_B			
B4	GND		GND	

Table 13: USB Host Interface Pin Layout

* switched with IC3

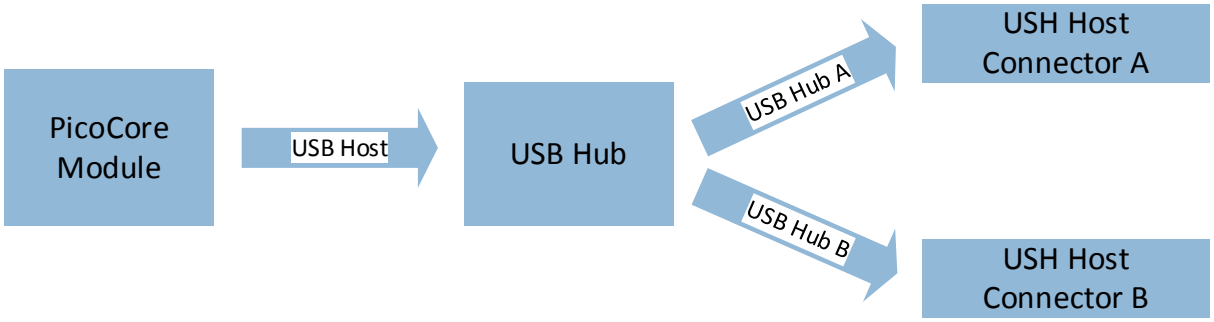

Figure 12: USB Host with USB Hub

4.9 J13 – Audio Interface

The PicoCore base board provides a 3.5mm audio jack with headphone and mic.
To improve the sound quality the voltage regulator for the audio codec is placed on the PicoCore base board.
Connector type: CUI SJ2-3574A-SMT-TR

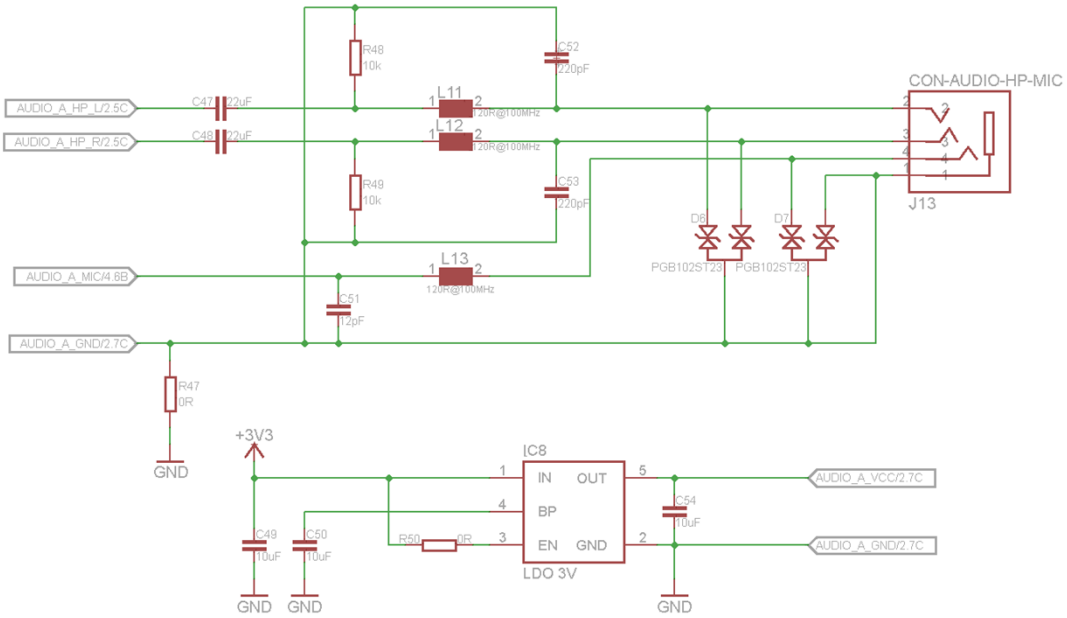

Figure 13: Audio

J4 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	AUDIO_A_GND	J2-69	PWR	GND	
2	AUDIO_A_HP_L	J2-71	O		
3	AUDIO_A_HP_R	J2-73	O		
4	AUDIO_A_MIC	J2-75	I		

Table 14: Headphone Jack Pin Layout

4.10 J14 - 24bit RGB LCD Interface

The PicoCore base board provides a 50 pol. Connector for a 24-bit RGB LCD interface with I²C.

Connector type: Harwin M50-3612542R

J14 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	BL_PWM		I/O	3.3V	
2	NC				
3	VLCD_EN	J1-54	I/O	3.3V	
4	NC				
5	GPIO1_J1_28	J1-28		3.3V	
6	NC				
7	VLCD		PWR	3.3V	
8	NC				
9	GNC		PWR		
10	NC				
11	LCD_R1	J1-49	I/O	3.3V	
12	LCD_R0	J1-47	I/O	3.3V	
13	LCD_G0	J1-65	I/O	3.3V	
14	LCD_G1	J1-67	I/O	3.3V	
15	LCD_B1	J1-66	I/O	3.3V	
16	LCD_B0	J1-64	I/O	3.3V	
17	+3V3		PWR		Was VLCD in PCB rev 1.20
18	+5VS		PWR		
19	GND		PWR		
20	LCD_PCLK	J1-50	I/O	3.3V	
21	LCD_HSYNC	J1-58	I/O	3.3V	
22	LCD_VSYNC	J1-60	I/O	3.3V	
23	GND		PWR		
24	LCD_R2	J1-51	I/O	3.3V	
25	LCD_R3	J1-53	I/O	3.3V	
26	LCD_R4	J1-55	I/O	3.3V	
27	LCD_R5	J1-57	I/O	3.3V	
28	LCD_R6	J1-59	I/O	3.3V	
29	LCD_R7	J1-61	I/O	3.3V	
30	GND		PWR		
31	LCD_G2	J1-69	I/O	3.3V	
32	LCD_G3	J1-71	I/O	3.3V	
33	LCD_G4	J1-73	I/O	3.3V	
34	LCD_G5	J1-75	I/O	3.3V	
35	LCD_G6	J1-77	I/O	3.3V	
36	LCD_G7	J1-79	I/O	3.3V	
37	GND		PWR		
38	LCD_B2	J1-68	I/O	3.3V	
39	LCD_B3	J1-70	I/O	3.3V	
40	LCD_B4	J1-72	I/O	3.3V	
41	LCD_B5	J1-74	I/O	3.3V	

42	LCD_B6	J1-76	I/O	3.3V	
43	LCD_B7	J1-78		3.3V	
44	GND		PWR		
45	LCD_DE	J1-56	I/O	3.3V	
46	VLCD		PWR	3.3V	
47	VLCD		PWR	3.3V	
48	I2C_B_SDA	J1-43	I/O	3.3V	Shared with J11
49	I2C_B_IRQ	J1-39	I/O	3.3V	Shared with J11
50	I2C_B_SCL	J1-41	I/O	3.3V	Shared with J11

Table 15: RGB Display Connector Pin Layout

4.11 J11 - I²C Touch Interface

The PicoCore base board provides a 6 pol. Connector with I²C signals.

Connector type: Hirose DF13-6P-1.25H(20)

J11 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	+3V3		PWR	3.3V	
2	I2C_B_SDA	J1-43	I/O	3.3V	Shared with J14
3	I2C_B_SCL	J1-41	O	3.3V	Shared with J14
4	NC		O	3.3V	
5	I2C_B_IRQ	J1-39	I	3.3V	Shared with J14
6	GND		PWR		

Table 16: Touch I2C Connector Pin Layout

4.12 J10 - Feature Connector

The PicoCore base board provides a 50 pin feature connector

J10 Pin	Signal Name	PicoCore Pin Number	I/O Type	Voltage	Remarks
1	+3V3		PWR	3.3V	
2	+5V		PWR	5V	
3	GPIO_J1_24	J1-44	I/O	3.3V	
4	GPIO_J1_26	J1-26	I/O	3.3V	
5	GPIO_J1_22	J1-39	I/O	3.3V	
6	GPIO_J1_30	J1-30	I/O	3.3V	
7	GPIO_J1_32	J1-32	I/O	3.3V	
8	GPIO_J1_34	J1-34	I/O	3.3V	
9	GPIO_J1_36	J1-36	I/O	3.3V	
10	GPIO_J1_38	J1-38	I/O	3.3V	
11	GND		PWR		
12	SPI_A_SCLK	J1-20	I/O	3.3V	
13	UART_D_TXD	J1-19	O	3.3V	
14	SPI_A_SS0	J1-14	O	3.3V	
15	UART_D_RXD	J1-17	I	3.3V	
16	SPI_A_MOSI / I2C_B_SCL	J1-18 / J1-41	I/O	3.3V	Depends on assembly. Default SPI_A_MOSI
17	SPI_A_MISO / I2C_B_SDA	J1-16 / J1-43	I/O	3.3V	Depends on assembly. Default SPI_A_MISO
18	GPIO_J1_40	J1-40	I/O	3.3V	
19	GPIO_J1_42	J1-42	I/O	3.3V	
20	GPIO_J1_37	J1-37	I/O	3.3V	
21	GPIO_J1_35	J1-35	I/O	3.3V	
22	GPIO_J1_33	J1-33	I/O	3.3V	
23	GPIO_J1_31	J1-31	I/O	3.3V	
24	GPIO_J1_29	J1-29	I/O	3.3V	
25	GPIO_J1_27	J1-27	I/O	3.3V	
26	GPIO_J1_25	J1-25	I/O	3.3V	
27	GND		PWR		
28	NC				
29	SD_A_DAT5	J1-2	I/O	3.3V / 1.8V	For more information see hardware doku of the PicoCore
30	NC				
31	SD_A_DAT7	J1-4	I/O	3.3V / 1.8V	For more information see hardware doku of the PicoCore
32	NC				
33	SD_A_DAT4	J1-1	I/O	3.3V / 1.8V	For more information see hardware doku of the PicoCore
34	NC				
35	SD_A_DAT6	J1-3	I/O	3.3V / 1.8V	For more information see hardware doku of the PicoCore
36	NC				
37	GND		PWR		

38	NC				
39	+3V3		PWR	3.3V	
40	+5VS		PWR	5V	
41	AUDIO_A_MIC	J2-75	I		
42	GND		PWR		
43	NC				
44	AUDIO_A_IN_R	J2-79	I		
45	AUDIO_A_OUT_R	J2-73	O		
46	GND		PWR		
47	GND		PWR		
48	AUDIO_A_IN_L	J2-77	I		
49	AUDIO_A_OUT_L	J2-71	O		

Table 17: Feature Connector Pin Layout

5 Power

J16	Signal Name	Remarks
1	N.C.	
2	VBAT IN	RTC battery input. Leave open if not used
3	+5V Power In	VCC in, 5V +/-5%
4	GND	GND, connect all GND pins to GND plane
5	N.C.	

Table 18: Power Inputs

6 Electrical Characteristic

6.1 Recommended Operation Conditions

Parameter	Description	Min	Typ	Max	Unit
VCC	Power supply voltage	4.75	5.0	5.25	V
VBAT_IN	RTC supply voltage	2.2	3.0	3.45	V

Table 19: Recommended Operation Conditions

6.2 ESD and EMI Requirements

On the PicoCoreBBRGB base board there are ESD protection diodes for USB and Audio Jack connectors. The other connectors do not have any protection, because of their immunity to ESD. To reduce EMI the PicoCore supports Spread spectrum. This will normally reduce EMI between 9 and 12 dB and so this decrease your shielding requirements. We strictly recommend having your baseboard with controlled impedance and wires as short as possible.
A helpful guide is available from TI; just search for slva680 at ti.com.

7 Matrix Code Sticker

All F&S hardware will ship with a matrix code sticker including the serial number.
Enter your serial number here https://www.fs-net.de/en/support/serial-number-info-and-rma/
to get information on shipping date and type of board.

Figure 14: Matrix Code Sticker

8 Appendix

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