Software

User Interface	Github interface
Webserver	

Testsoftware
(runs and coordinates tests to verify the code)

API to control hardware

Firmware (Hardware Drivers)

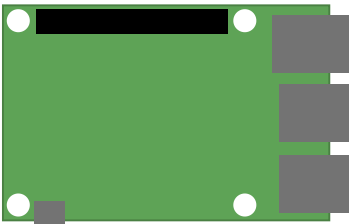| Probe 1 | | Target 1 |
Probe 2	Testsystem Hardware Rpi, Shields, ...	Target 2
...		...
Probe N		Target N

Hardware

Layout

1x
Raspberry Pi 4B
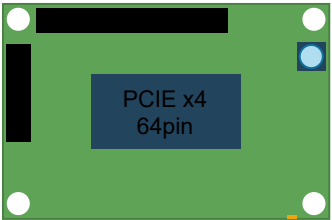
ETH   **To user / To Cluster controller**

2x USB 3.0

2x USB 2.0

To probes

6cm or
custom size

ca 18-25cm

Optional
probe holder

1x
Probe Shield

ARM 10 pin connector

40 Pin 2.56mm GPIO Connector

20 Pin 2.56mm Probe Bus Connector
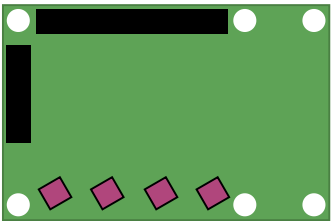
up to 8x
Target Stack Shield

PCIE x4
64pin

6cm or
custom size

Target Daugtherboard

MCU   MCU
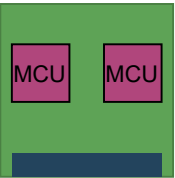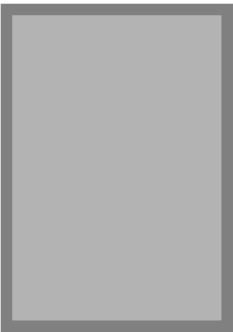
Max 4 MCU per board

PCIE x4
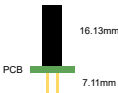64pin
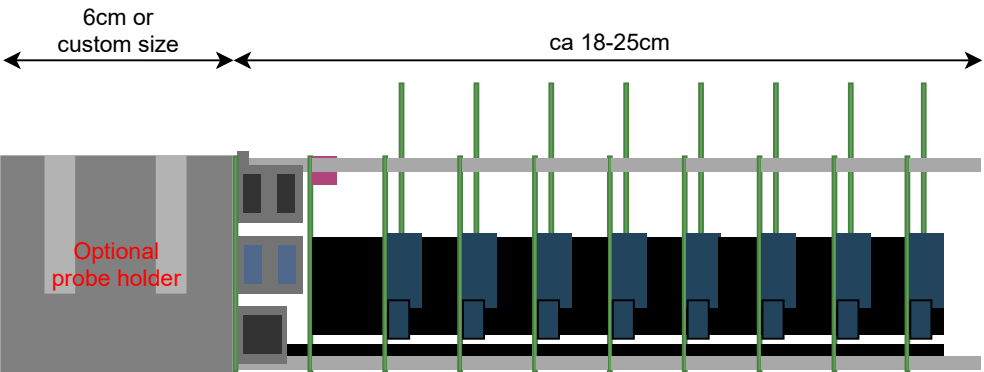
Optional:

1x
3D Printed probe holder

(US projection)

Connectors

Possible GPIO shield / Probe shield pass through connectors:

ESQ-120-34-L/T-D (40Pin)
ESQ-110-34-L/T-D (20Pin)

16.13mm
PCB
7.11mm

Price: ~8-10CHF

Availability: Non plated, mediocre

SSQ-120-04-L/T-D (40Pin)
SSQ-110-04-L/T-D (20Pin)

8.51mm
PCB
Board spacing ca 16mm
14.83mm
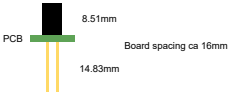
Price: ~3-6CHF

Availability: non plated ok

TSM-120-03-F/L-DV (40Pin)
TSM-110-03-F/L-DV (20Pin)
with
SSM-120-F/L-DV (40Pin)
SSM-110-F/L-DV (20Pin)

7.37mm
PCB
Board spacing ca 17mm
14.48mm
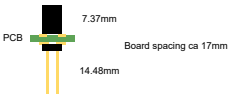
Price: ~9CHF per pair

Availability: ok

ESQ-120-14-L/T-D (40Pin)
ESQ-110-14-L/T-D (20Pin)

Board spacing ca 16mm
11.5mm
PCB
12.19mm
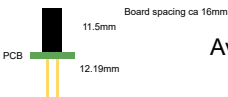
Price: ~4-7CHF

Availability: Non plated, good

Possible RPI to first shield connectors:

Adafruit 1112

23mm
PCB
10mm
Can't be used with SSQ or TSM/SSM

Price: ~2CHF

Availability: ok

ESQ-120-14-L/T-D

11.05mm
PCB
12.19mm
Can't be used with SSQ or TSM/SSM

Price: ~7CHF

Availability: ok

Possible ARM 10pin debug connectors:

FTSH-105-01-F-DV-007-K
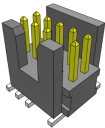
Price: ~3-4CHF

Availability: ok

Target Stack
   Shield

5V from
GPIO shield
connector

**3.3V
LDO
1A**

3.3V stack
shield power

1 GPIO Target Board Detect

**Target 64Pin PCI
connector**

Stack position selector
Rotary DIP or solder bridges

Address

4 GPIO

Target 0   Target 1   Target 2   Target 3

16-Bit Bus Switch

Required DO to control switching: 8

GPIO
shield connector

I2C from Rpi

**I2C
Address
Translator**

**IO
Expander
16 Bit**

3 GPIO

OK
No Daughterboard
Error

**Status
LED**

Optional in case IO
expander does not
support at least 8
different addresses

16-Bit combined
Probe/GPIO bus

GPIO Channel 0

Probe Channel 0

Switch concept

GPIO Channel 1

Probe Channel 1

GPIO Channel 2

Probe Channel 2

GPIO Channel 3

Probe Channel 3

4 GPIO

GPIO
shield connector

Probe
shield connector

Raspberry 40pin connector
config bcm2711
(rpi designations)

Per GPIO channel: 4x GPIO, 1x UART
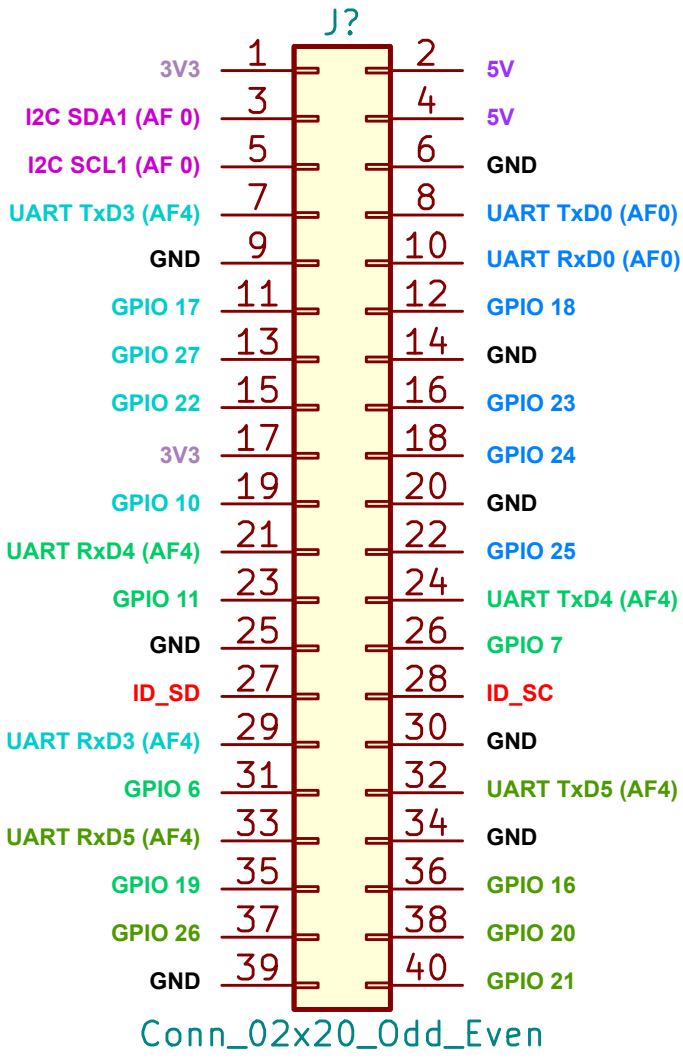
J?

3V3	1	2	5V
I2C SDA1 (AF 0)	3	4	5V
I2C SCL1 (AF 0)	5	6	GND
UART TxD3 (AF4)	7	8	UART TxD0 (AF0)
GND	9	10	UART RxD0 (AF0)
GPIO 17	11	12	GPIO 18
GPIO 27	13	14	GND
GPIO 22	15	16	GPIO 23
3V3	17	18	GPIO 24
GPIO 10	19	20	GND
UART RxD4 (AF4)	21	22	GPIO 25
GPIO 11	23	24	UART TxD4 (AF4)
GND	25	26	GPIO 7
ID_SD	27	28	ID_SC
UART RxD3 (AF4)	29	30	GND
GPIO 6	31	32	UART TxD5 (AF4)
UART RxD5 (AF4)	33	34	GND
GPIO 19	35	36	GPIO 16
GPIO 26	37	38	GPIO 20
GND	39	40	GPIO 21

Conn_02x20_Odd_Even

I2C Bus: Controls all IO expanders on Target Stack Shields
3V3: Unused
5V: Power source for shields
ID_XX: Unused

GPIO Channels:
- Channel 0
- Channel 1
- Channel 2
- Channel 3

GPIO shield connector
(hive designations)

Per GPIO channel: 4x GPIO, 1x UART

J?

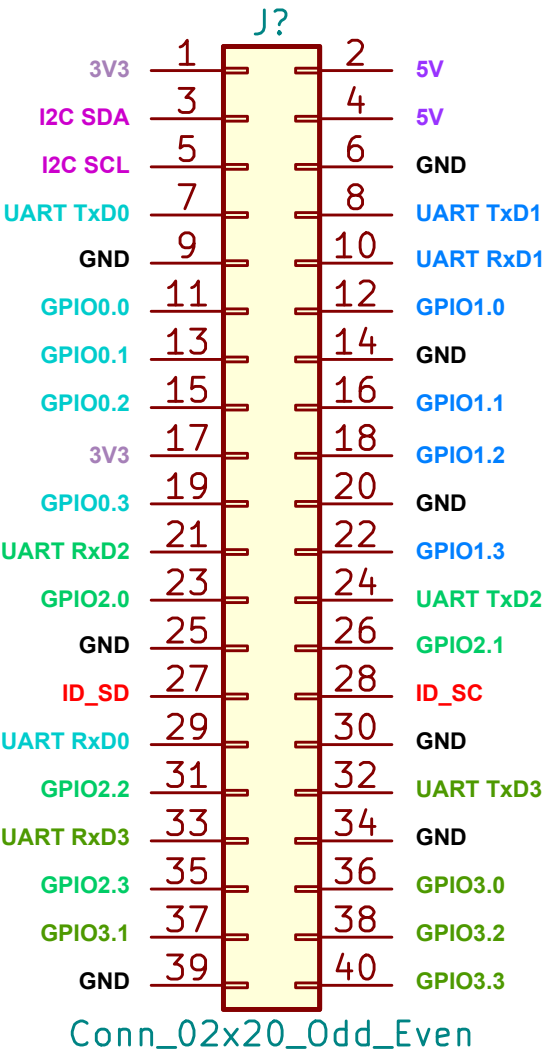|			
3V3	1	2	5V
I2C SDA	3	4	5V
I2C SCL	5	6	GND
UART TxD0	7	8	UART TxD1
GND	9	10	UART RxD1
GPIO0.0	11	12	GPIO1.0
GPIO0.1	13	14	GND
GPIO0.2	15	16	GPIO1.1
3V3	17	18	GPIO1.2
GPIO0.3	19	20	GND
UART RxD2	21	22	GPIO1.3
GPIO2.0	23	24	UART TxD2
GND	25	26	GPIO2.1
ID_SD	27	28	ID_SC
UART RxD0	29	30	GND
GPIO2.2	31	32	UART TxD3
UART RxD3	33	34	GND
GPIO2.3	35	36	GPIO3.0
GPIO3.1	37	38	GPIO3.2
GND	39	40	GPIO3.3

Conn_02x20_Odd_Even

I2C Bus: Controls all IO expanders on Target Stack Shields
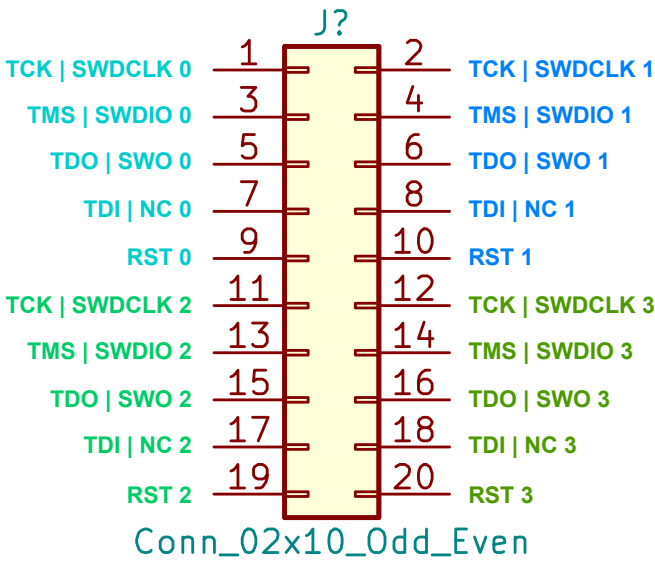**3V3:** Unused
5V: Power source for shields
ID_XX: Unused

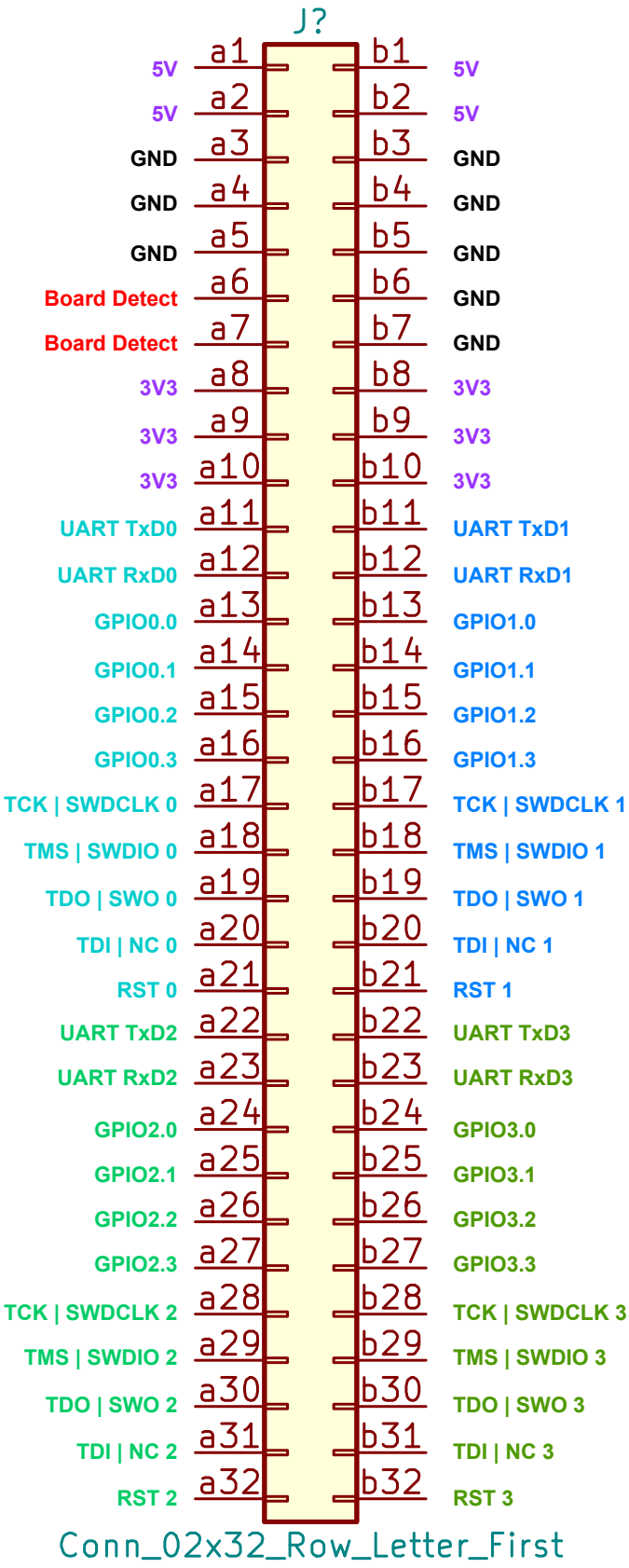**GPIO Channels:**
- Channel 0
- Channel 1
- Channel 2
- Channel 3

Probe shield connector
(hive designations)

J?

TCK | SWDCLK 0	1	2	TCK | SWDCLK 1
TMS | SWDIO 0	3	4	TMS | SWDIO 1
TDO | SWO 0	5	6	TDO | SWO 1
TDI | NC 0	7	8	TDI | NC 1
RST 0	9	10	RST 1
TCK | SWDCLK 2	11	12	TCK | SWDCLK 3
TMS | SWDIO 2	13	14	TMS | SWDIO 3
TDO | SWO 2	15	16	TDO | SWO 3
TDI | NC 2	17	18	TDI | NC 3
RST 2	19	20	RST 3

Conn_02x10_Odd_Even

Probe Channels:
- Channel 0
- Channel 1
- Channel 2
- Channel 3

Target 64Pin PCI connector
(hive designations)

J?

5V	a1	b1	5V
5V	a2	b2	5V
GND	a3	b3	GND
GND	a4	b4	GND
GND	a5	b5	GND
Board Detect	a6	b6	GND
Board Detect	a7	b7	3V3
3V3	a8	b8	3V3
3V3	a9	b9	3V3
3V3	a10	b10	3V3
UART TxD0	a11	b11	UART TxD1
UART RxD0	a12	b12	UART RxD1
GPIO0.0	a13	b13	GPIO1.0
GPIO0.1	a14	b14	GPIO1.1
GPIO0.2	a15	b15	GPIO1.2
GPIO0.3	a16	b16	GPIO1.3
TCK | SWDCLK 0	a17	b17	TCK | SWDCLK 1
TMS | SWDIO 0	a18	b18	TMS | SWDIO 1
TDO | SWO 0	a19	b19	TDO | SWO 1
TDI | NC 0	a20	b20	TDI | NC 1
RST 0	a21	b21	RST 1
UART TxD2	a22	b22	UART TxD3
UART RxD2	a23	b23	UART RxD3
GPIO2.0	a24	b24	GPIO3.0
GPIO2.1	a25	b25	GPIO3.1
GPIO2.2	a26	b26	GPIO3.2
GPIO2.3	a27	b27	GPIO3.3
TCK | SWDCLK 2	a28	b28	TCK | SWDCLK 3
TMS | SWDIO 2	a29	b29	TMS | SWDIO 3
TDO | SWO 2	a30	b30	TDO | SWO 3
TDI | NC 2	a31	b31	TDI | NC 3
RST 2	a32	b32	RST 3

Conn_02x32_Row_Letter_First

3V3: 3.3V supplied from shield LDO. Not from rpi 3.3V!
5V: 5V supplied by power supply usb c rpi input
Board Detect: Needs to be connected together on daughterboard, allows shield to detect if daughterboard is present

Channels:
- Channel 0
- Channel 1
- Channel 2
- Channel 3