Software

User Interface	Github interface
Webserver	

Testsoftware
(runs and coordinates tests to verify the code)

API to control hardware

Firmware (Hardware Drivers)

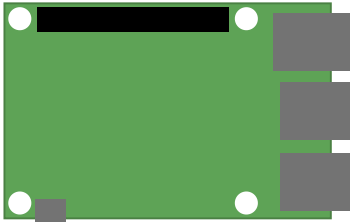| Probe 1		Testsystem Hardware Rpi, Shields, ...		Target 1
Probe 2				Target 2
...				...
Probe N				Target N

Hardware

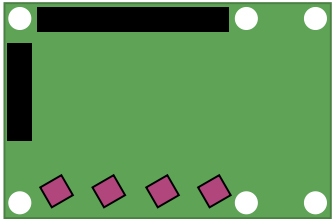# Layout

1x
Raspberry Pi 4B

ETH   **To user / To Cluster controller**

2x USB 3.0

2x USB 2.0

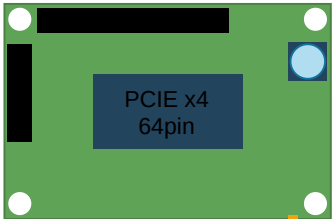**To probes**

1x
Probe Shield

ARM 10 pin connector

40 Pin 2.56mm GPIO Connector

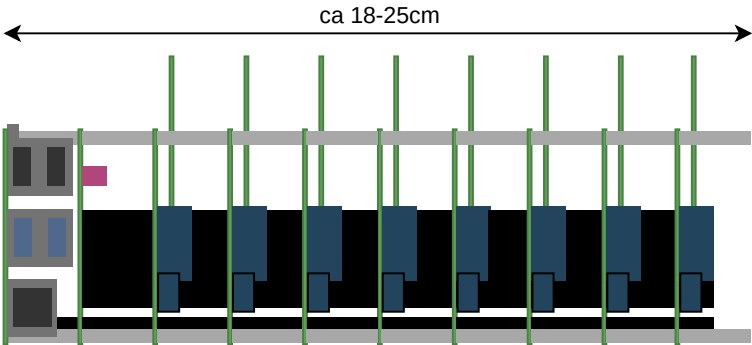20 Pin 2.56mm Probe Bus Connector

up to 8x

Target Stack Shield

PCIE x4
64pin

Target Daugtherboard

MCU   MCU
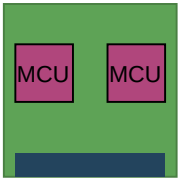
Max 4 MCU per board

PCIE x4
64pin

ca 18-25cm

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
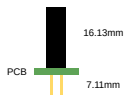
Price: ~8-10CHF

Availability: Non plated, ok

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

8.51mm

PCB

Board spacing ca 17mm

14.83mm
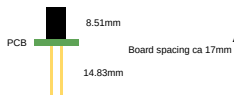
Price: ~3-6CHF

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
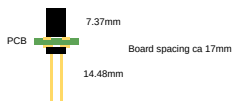
Price: ~9CHF per pair

Availability: ok

Possible ARM 10pin debug connectors:

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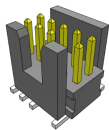
Price: ~3-4CHF

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

16-Bit Bus Switch

Required DO to control switching: 8

GPIO shield connector

Address

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

4 GPIO

Target 0   Target 1   Target 2   Target 3

16-Bit combined Probe/GPIO bus

Switch concept

GPIO Channel 0

Probe Channel 0

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
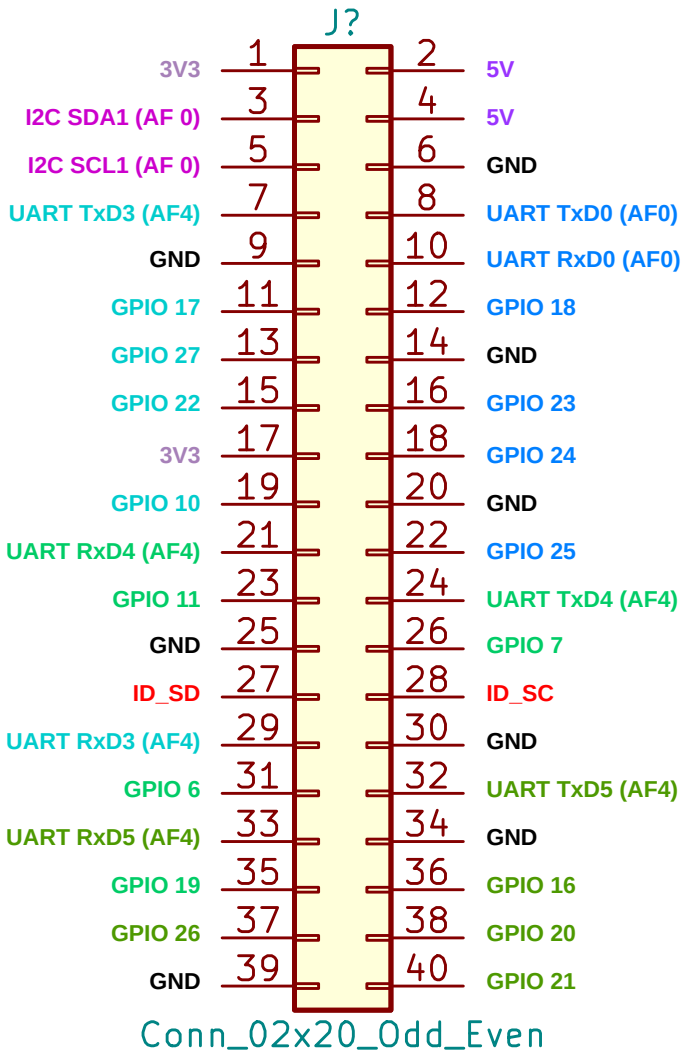
J?

Left	Pin	Pin	Right
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?

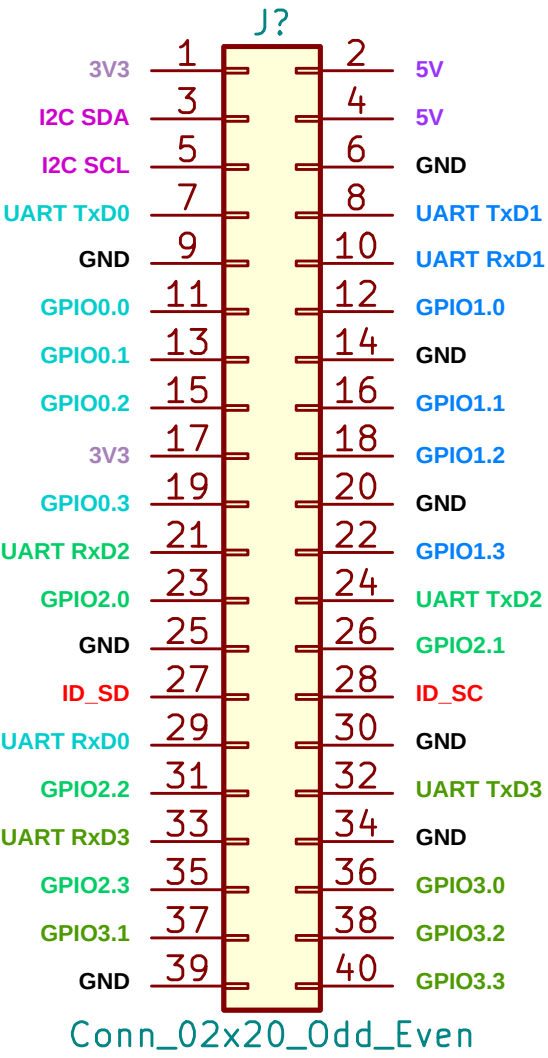| Left	Pin	Pin	Right
3V3	1	2	5V
I2C SDA	3	4	5V
I2C SCL	5	6	GND
UART TxD0	7	8	UART TxD1
GND	9	10	UART RxD1
GPIO0.0	11	12	GPIO1.0
GPIO0.1	13	14	GND
GPIO0.2	15	16	GPIO1.1
3V3	17	18	GPIO1.2
GPIO0.3	19	20	GND
UART RxD2	21	22	GPIO1.3
GPIO2.0	23	24	UART TxD2
GND	25	26	GPIO2.1
ID_SD	27	28	ID_SC
UART RxD0	29	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
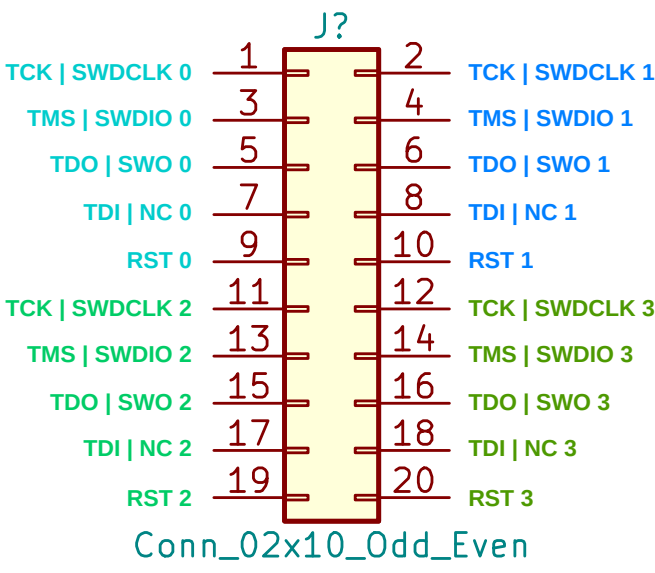**3V3:** Unused
5V: Power source for shields
ID_XX: Unused
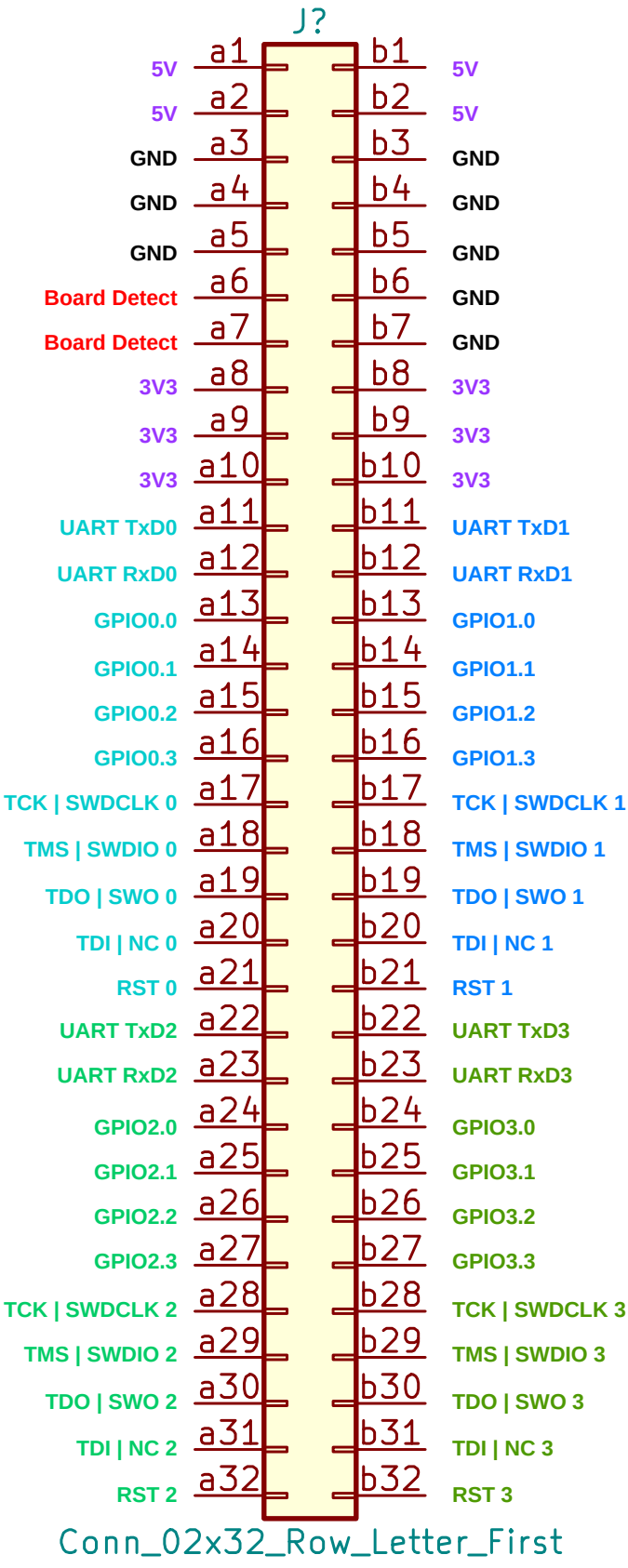
GPIO Channels:
- Channel 0
- Channel 1
- Channel 2
- Channel 3

Probe shield connector (hive designations)

J?

Left	Pin	Pin	Right
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?

Left	Pin	Pin	Right
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	GND
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