

Ref: Fig 63 in BBONEBLK_SRM

PCB Manufacturing Constraints

- Size 54.1 x 75.2 mm, 6 Layer
- 0.15 mm Track Width
- 0.15 mm Copper Clearance
- 0.38 mm Edge Clearance
- 0.35 mm Toolsize / non plated Hole
- 0.20 | 0.35 mm Plated Hole | Annular Ring Dia
- 2.54 mm milling radius
- Solder Paste Pads are optimized for a 70 - 110 um Stencil

Assembly (v2.4)

- 2 Variations, recorder / emulator are self-contained and optional
- with Rec & Emu => 353 parts, 53 unique
- with Emu => X parts, X unique
- Mech-15 contains assembly notes / Pick and Place
- marking origin of part: cross (+) on assembly notes layer
- marking pad 1 of ICs: chamfered edge and circle (assembly notes) and filled triangle (silk)
- marking cathode of diodes: "C" or chamfered edge (assembly notes) and filled triangle (silk)
- Mech-2 contains Top Part Designators
- smallest part 0402
- smallest pitch 0.35 mm, XSON8
- only top layer populated

Manual Assembly

- Mech-13 contains info about non-reflow parts (8 items)

BOM-Additions

P1

BeagleBoneGreen

M9

LogoShepherd

M5

LayerWindow

**BOM PMEG1001-Alternative**

SMMSD701T1G IR = 1.4 nA
PMEG1001ELRX IR = 2.1 nA
RB168MM-40TR IR = 8.0 nA

External-BOM

Ethernet Cables
POE-Adapter
uSD-Card (for flashing)

Calibration Resistors
1k-0603-0.05% 667-ERA-3ARW102V
100R-0603-0.05% 754-RG1608N-101-W-T1

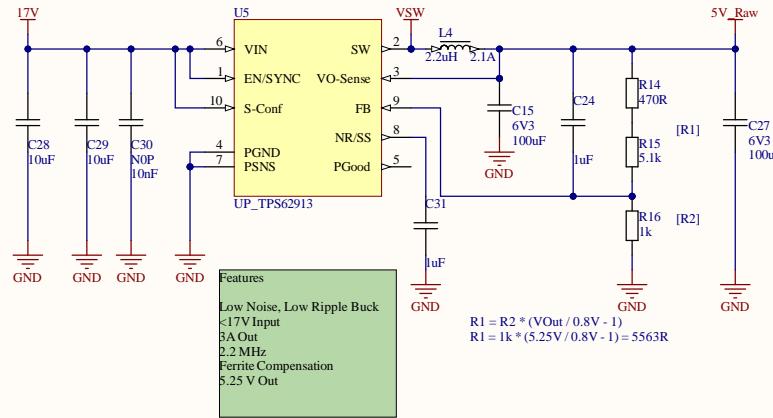
Pinheader Connection BBone Variants
2x23 Header > 77313-802-46LF 1.3 €
2x23 LongPinSocket
Samtec SSQ-123-23-G-D or 03-G-D 6 € (Default in BOM)
Major League SSHQ-123-D-10-G-LF 3 €
2x11 LongPinSocket & 2x12 Header
Samtec SSQ-111-03-G-D 3 €
Amphenol 10129381-924003BLF 0.4 €

Title Shepherd - Overview
NES Lab / TU Dresden

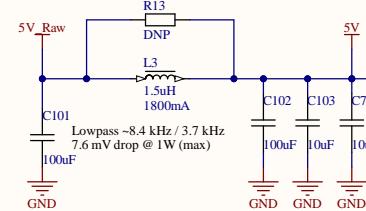
Size	Number	Revision
A4		
Date:	4/01/2025	Sheet of shepherd_v2.PriPcb
File:	C:\Users\...\overview.SchDoc	Drawn By: Ingmar

LowNoise-BuckConverter

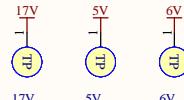
MAX 17V



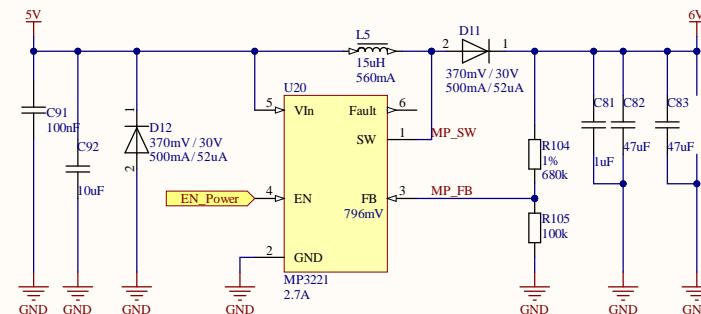
LC-LowPass (Optional)



Optional Caps / Backside

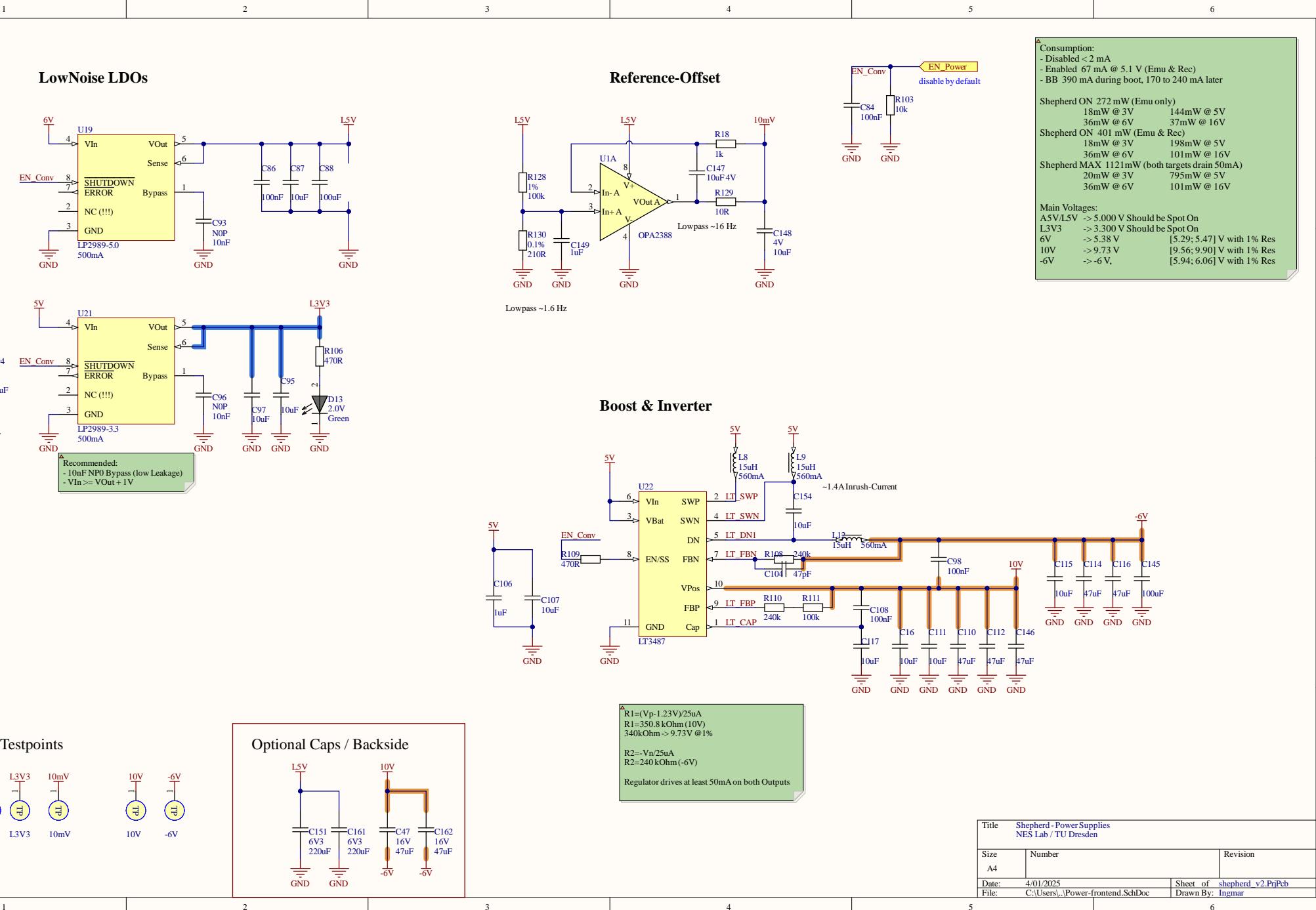


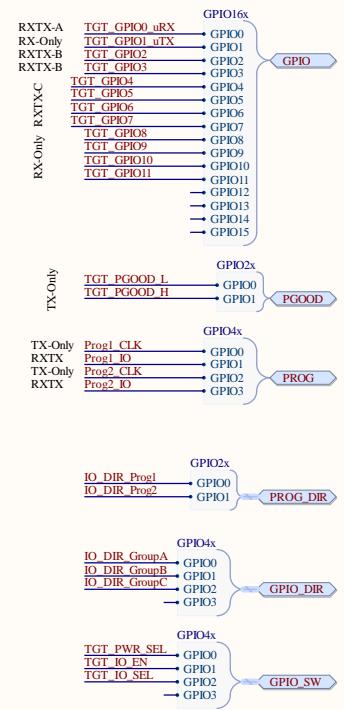
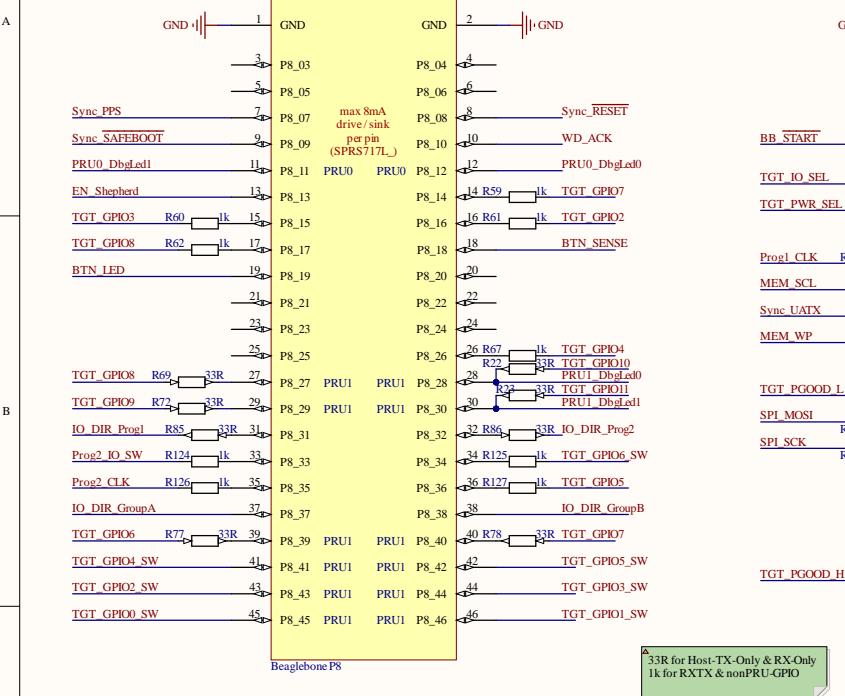
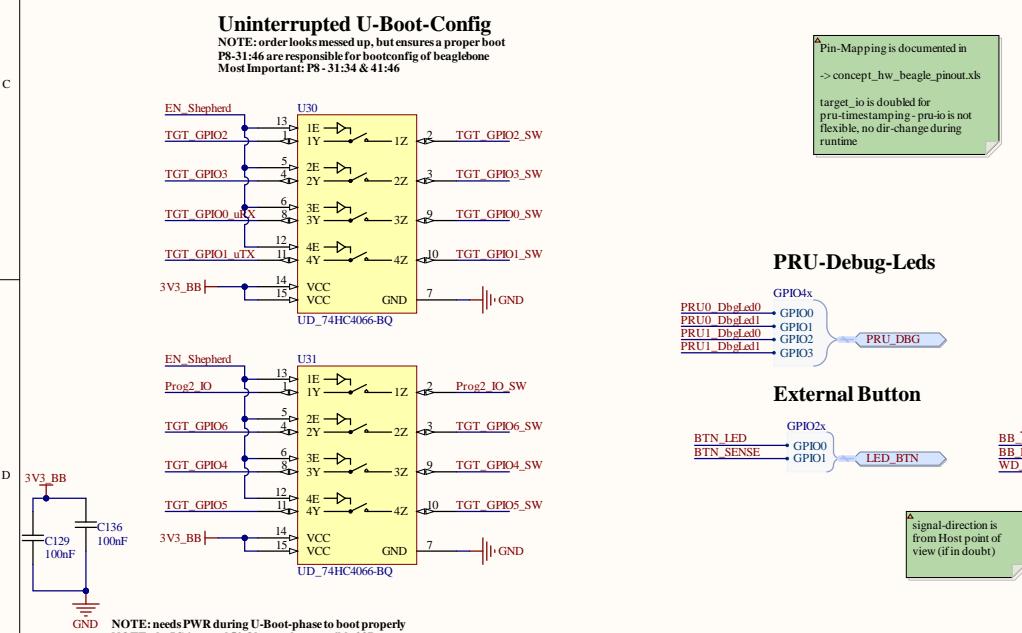
BoostConverter



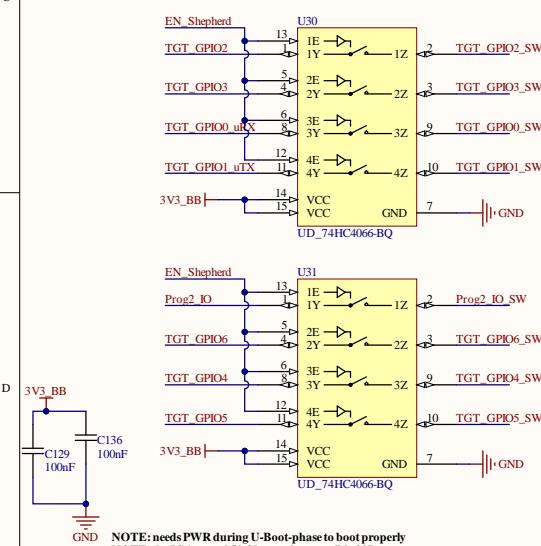
Title Shepherd - Input Voltage Converters
NES Lab / TU Dresden

Size	Number	Revision
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File: C:\Users\...\Power-input.SchDoc		

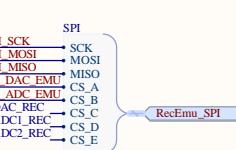


Target**Beaglebone Pinheader P8****Beaglebone Pinheader P9****Uninterrupted U-Boot-Config**

NOTE: order looks messed up, but ensures a proper boot
P8-31:46 are responsible for bootconfig of beaglebone
Most Important: P8 - 31:34 & 41:46

**PRU-Debug-Leds****External Button****Sys_Watchdog**

signal-direction is from Host point of view (if in doubt)

Calibration_Storage**Emulator & Recorder****Emulator & Recorder**

EN_Shepherd → EN_Shepherd, EN_Emulator → EN_Emulator.

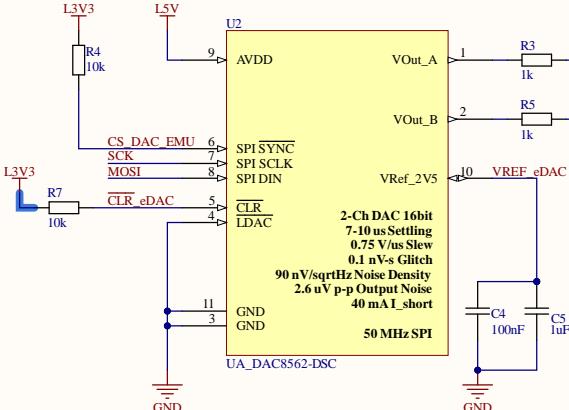
Sync-Adapter

Title: Shepherd - Host Interface
NES Lab / TU Dresden

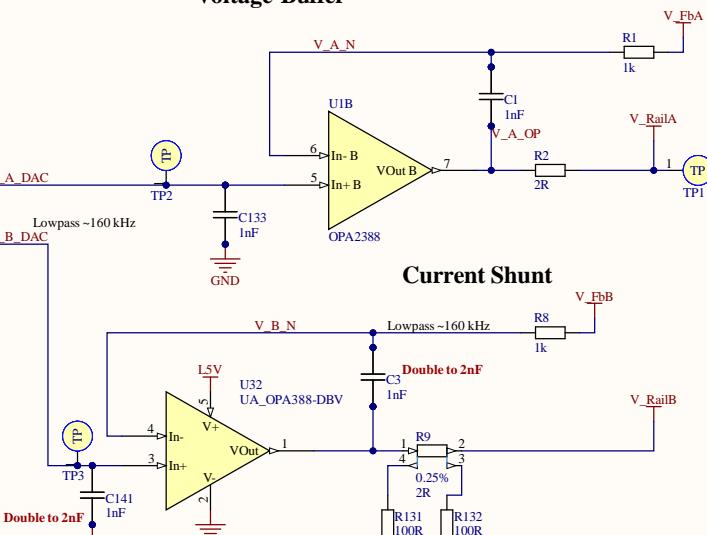
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File: C:\Users\...\Host-Interface.SchDoc		Drawn By: Ingmar

1 2 3 4 5 6

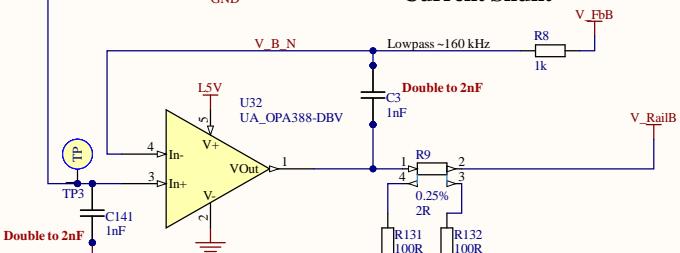
precision DAC



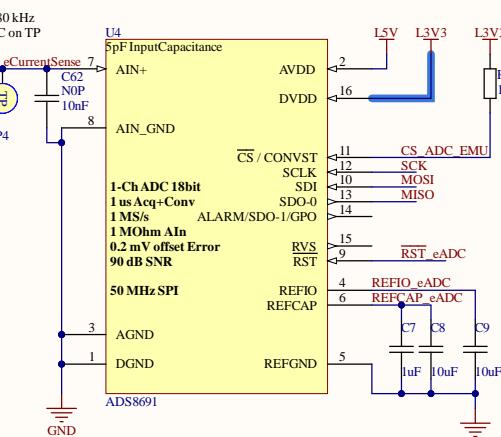
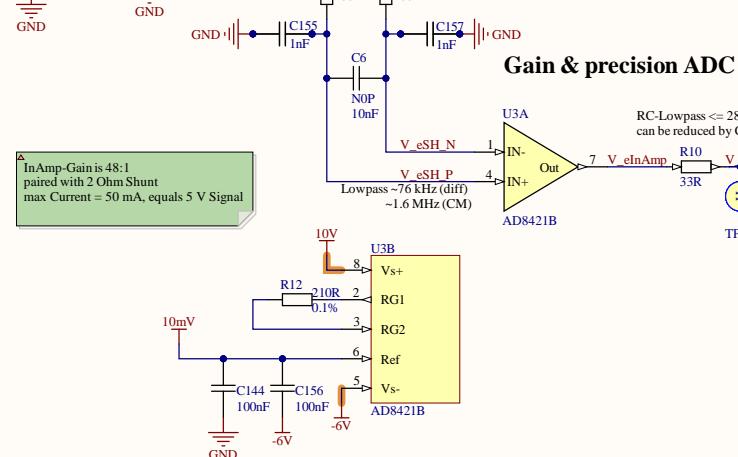
Voltage-Buffer



Current Shunt



Gain & precision ADC



A

A

B

B

C

C

D

D

1

2

3

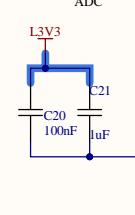
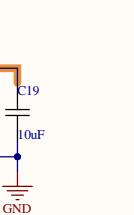
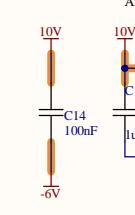
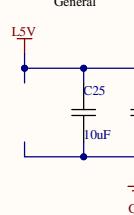
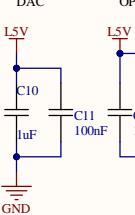
4

5

6

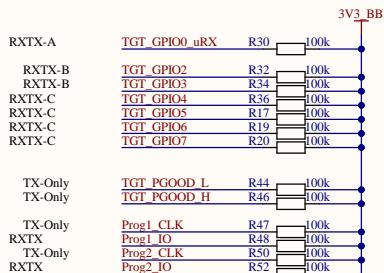
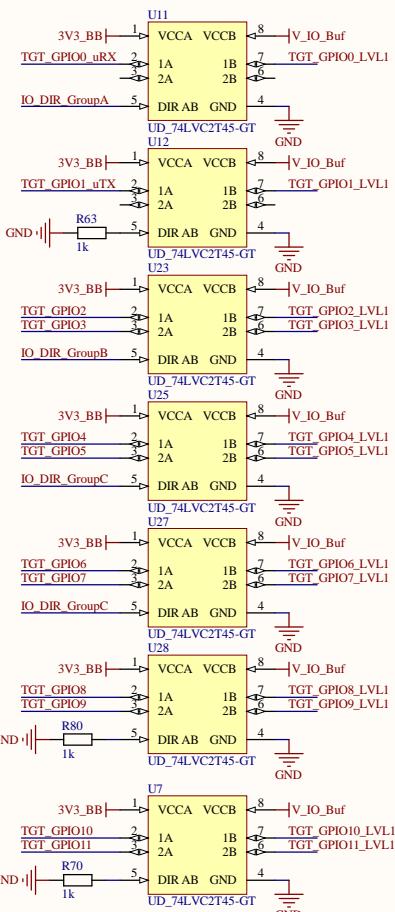
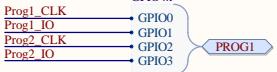
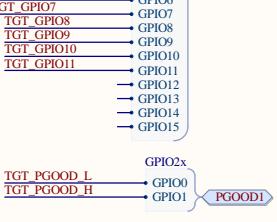
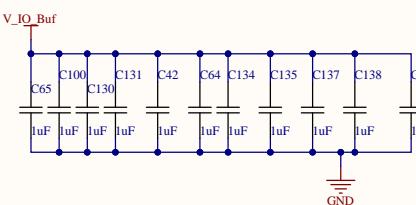
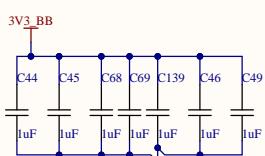
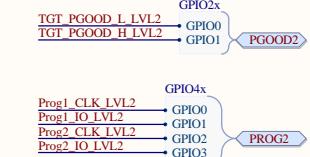
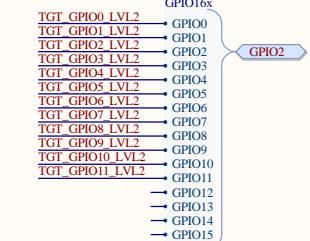
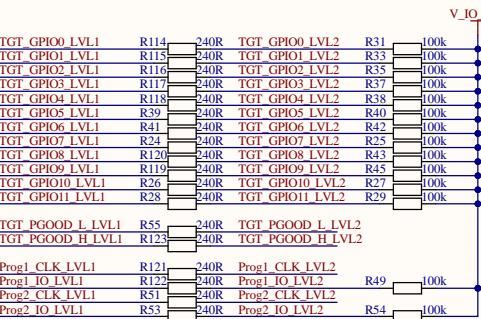
for Performance-Analysis see Recorder-Schematic
Signal-Propagation-Delay
Noise-Estimate
Signal Ranges

InAmp-Gain is 48:1 paired with 2 Ohm Shunt
max Current = 50 mA, equals 5 V Signal



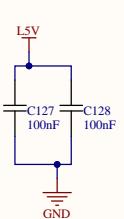
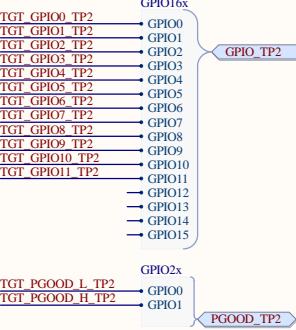
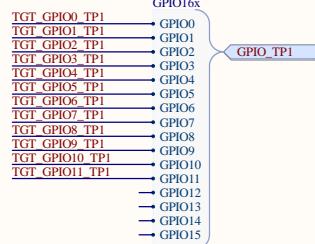
Interchangeable Version with 500 kS & 100 kS

Title Shepherd -Emulator Frontend NES Lab / TU Dresden		
Size A3	Number	Revision
Date: 4/01/2025	Sheet of shepherd_v2.PnjPcb	
File: C:\Users\...\Emulator.SchDoc		Drawn By: Ingmar

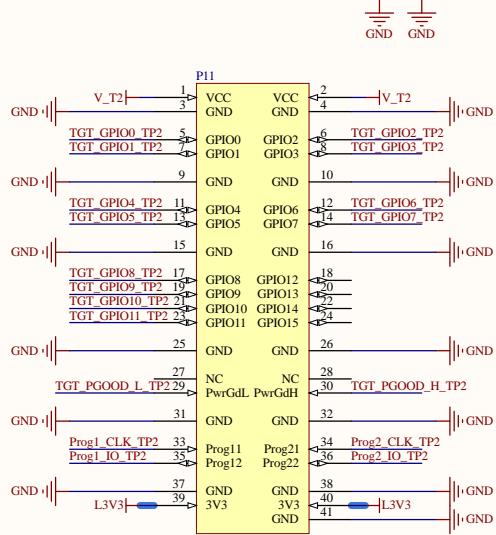
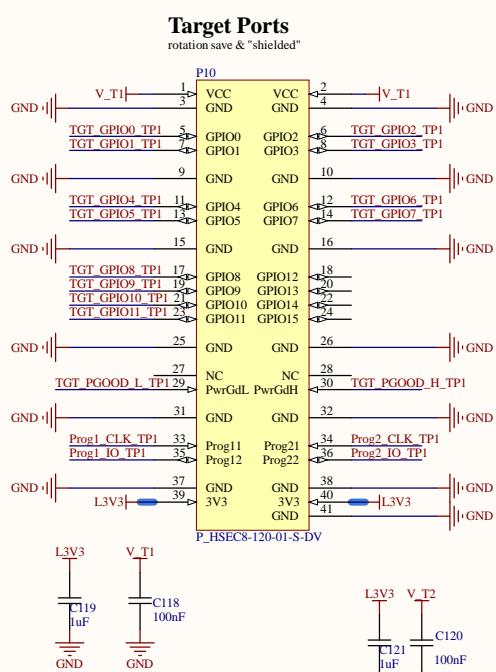
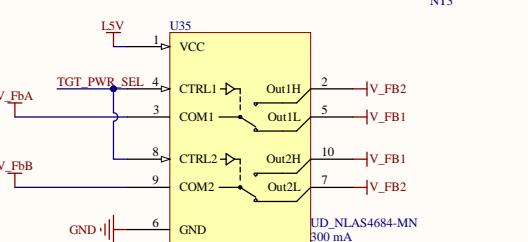
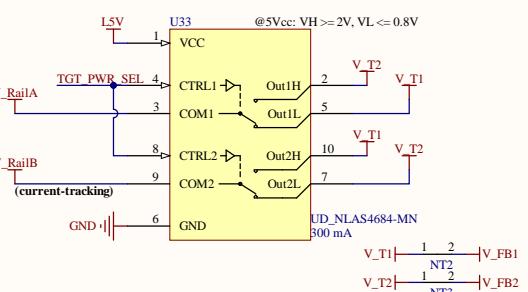
SideA - Pull Ups**Level Translators****SideB - Shunts & Pull Ups**

Title Shepherd - Level Translators
NES Lab / TU Dresden

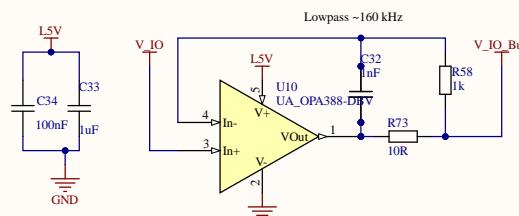
Size A3	Number	Revision
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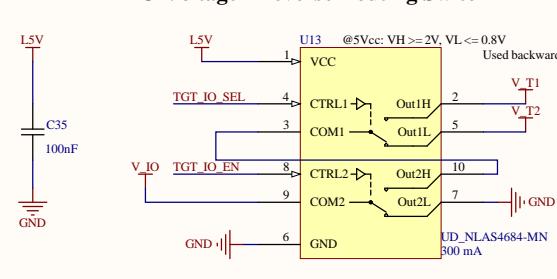
Power Switches



IO-Voltage - Buffer



IO-Voltage - Reverse Routing Switch



Programming-Hints:

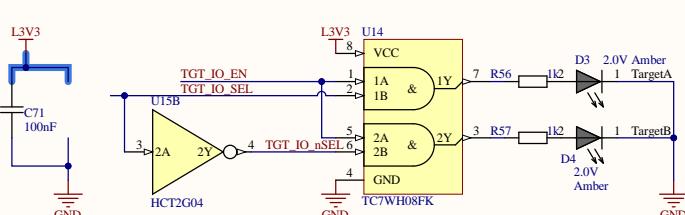
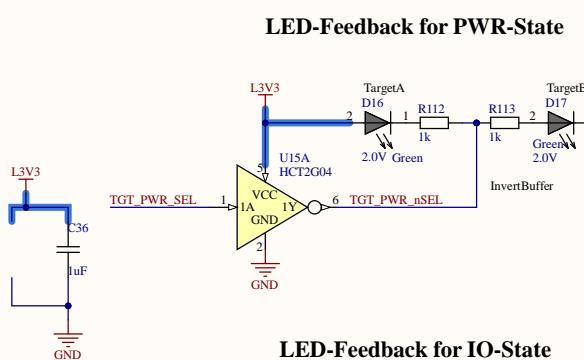
- Equalize DACs before switching
- unused GPIO should be switched to Input (target and bbone)
- level translators can be switched to other target for low leakage

Leakage Analysis (max per Pin):

NLAS4684	1-2 nA
NXS0101	1 uA
LSF010x	1-5 uA

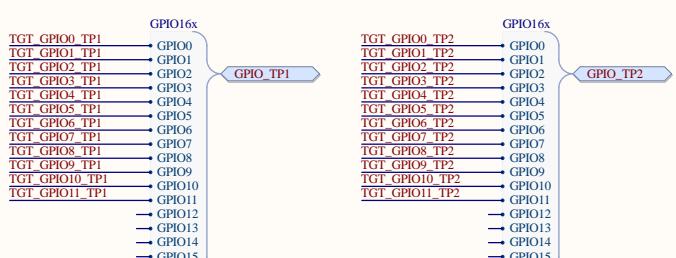
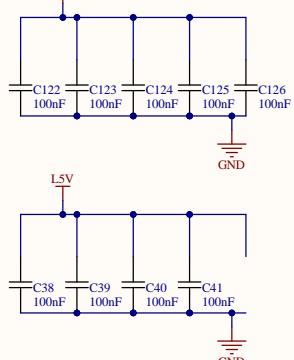
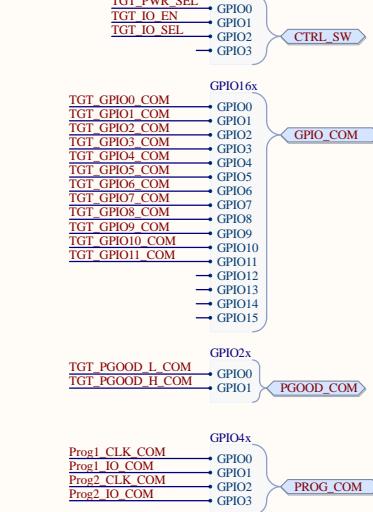
Max Current:

Target Switches	300mA
3V3(unmonitored)	250mA
V_Target -> OPA#388 VoltageBuffers source 30-60mA, current measurement up to 50mA	



Title Shepherd - Target Interface NBS Lab / TU Dresden		
Size A3	Number	Revision
Date: 4/01/2025	Sheet of shepherd_v2.PjPcb	
File: C:\Users...\Targets.SchDoc	Drawn By: Ingmar	

Signal Switches



5

6

7

8

A

B

C

D

SEL	Tar1	Tar2
0	VA	VB
1	VB	VA

only VB has current-tracking
=> so SEL=1 enables tracking of Target 1
0 enables tracking of Target 2

Title Shepherd - Signal Routing		
Size A3	Number	Revision
Date: 4/01/2025	Sheet of shepherd_v2.PriPcb	
File: C:\Users\...\SignalRouting.SchDoc	Drawn By: Ingmar	

