Schematic Revision History

V2.0 July 2022. Contributed by Dennis Yaskevich, Michael Anderson and Jose Yesta Lozano

V2.1 August 2023 Contributed by Dennis Yaskevich and Michael Anderson

V2.1 Changes

1. Replace TXB0106PWR with TXS0102DQMR that supports open drain for i2c usage.
   Mux ABCD lines converted to discrete level translation ala previous version mux enable pin.
2. Changed R18 resistor to be between TP14 and junction between pin 8 on AD8137 and R17
3. Eliminated PD pin on arduino pin A7 as its not needed. Pin is designed to float on AD8137 in on state (verify float feature)
4. Moved d_pin from aref to A7 on arduino due to issues in using aref as a GPIO pin
5. Added 0.1uF bypass capacitors on bilevel translator per data sheet
6. Changed L4 inductance from 10uH to 22uH (BOM updated)
7. Connected CS from TP5100 to A0 on MCU. Pulled up with 10k to 3V3. (BOM updated)
8. Added in MRA4003T3G diode to pwr in for MCU to prevent MCU from powering board when only connected to computer
9. Eliminated Standby pin connection to MCU from the TP5100 IC
10. Adding in external I2C interfaced DAC IC (MCP4725A0T-E/CH). Tied A0 pin to Vss (GND) pin.
11. Added in separate LDO voltage regulator (AP2204K-ADJTRG1) to only pwr negative rail charge pump.
12. Added pullup resistor (10k Ohms) to enable pin for charge pump IC (LM27761DSGR).
13. Added 220Ohm load to -5 rail line for LM27761DSG IC (charge pump U3)
14. Added in 1M Ohm pull down resistors for V1 and V2 inputs for U2 op amp.
15. 5V LDO replaced with MIC5209 with enable pin feature
16. U30 OpAmp is replaced with an alternative with single circuit. 1.65V rail is not used anymore
17. Block diagram updated to reflect architectural changes
18. Swap R83 and R82
19. Flip vertically Q16,1,10,8 and 6

V2.2 Changes

1. Fix mistake in 5.3V LDO. Swap R82 and R83
2. Fix mistake in level translator. Mirror Q1 Q6 Q8 Q10 Q16
3. Update PCB silkscreen
4. Connect CHRG_EN pull up to VREG instead of 3V3

NOTES

All resistors are 1% tolerance unless otherwise noted

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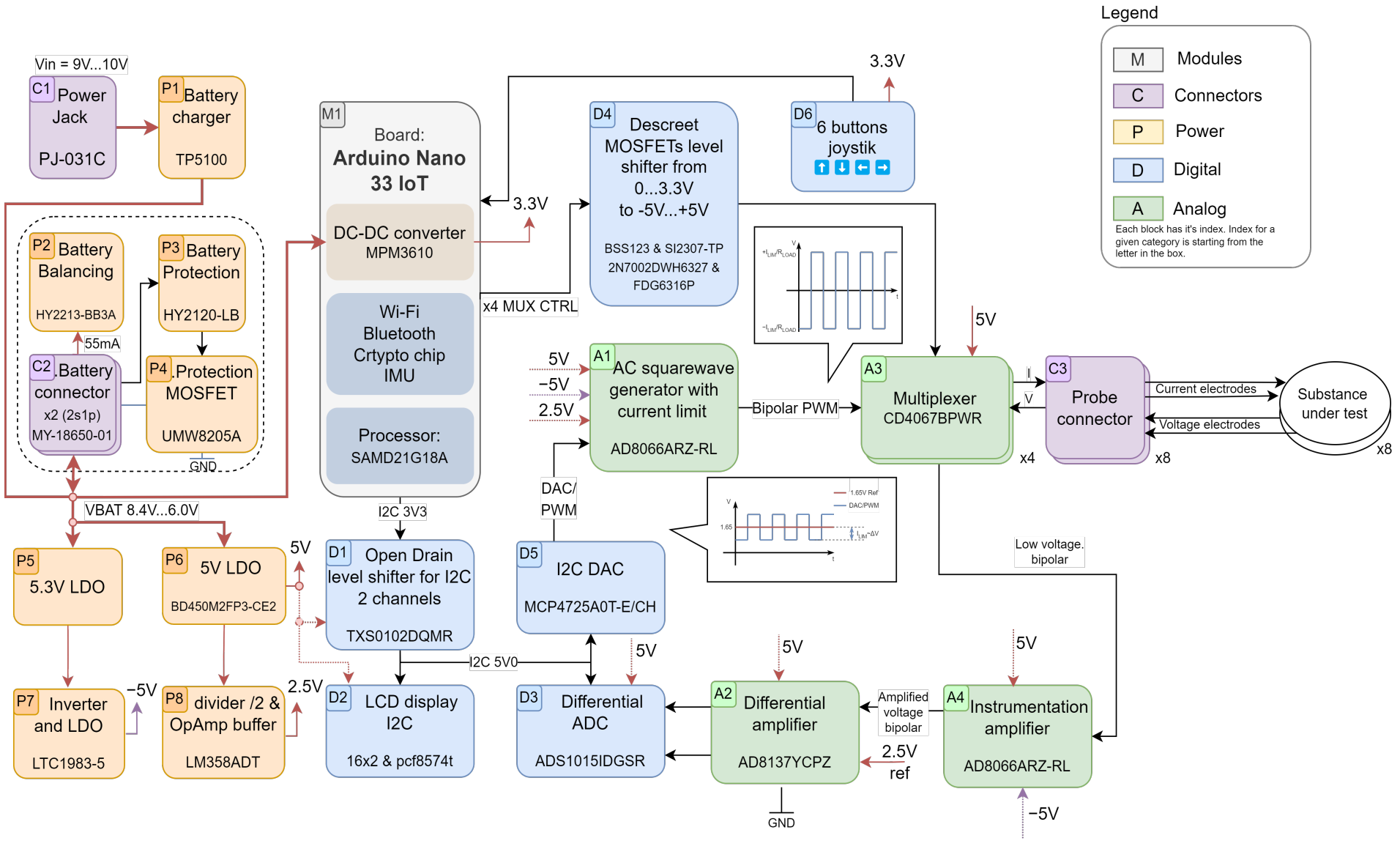
Flexi-TEER block diagramm Rev.0.6



S5 Board Support

S6 Board Support

S7 Board Support

S8 Board Support

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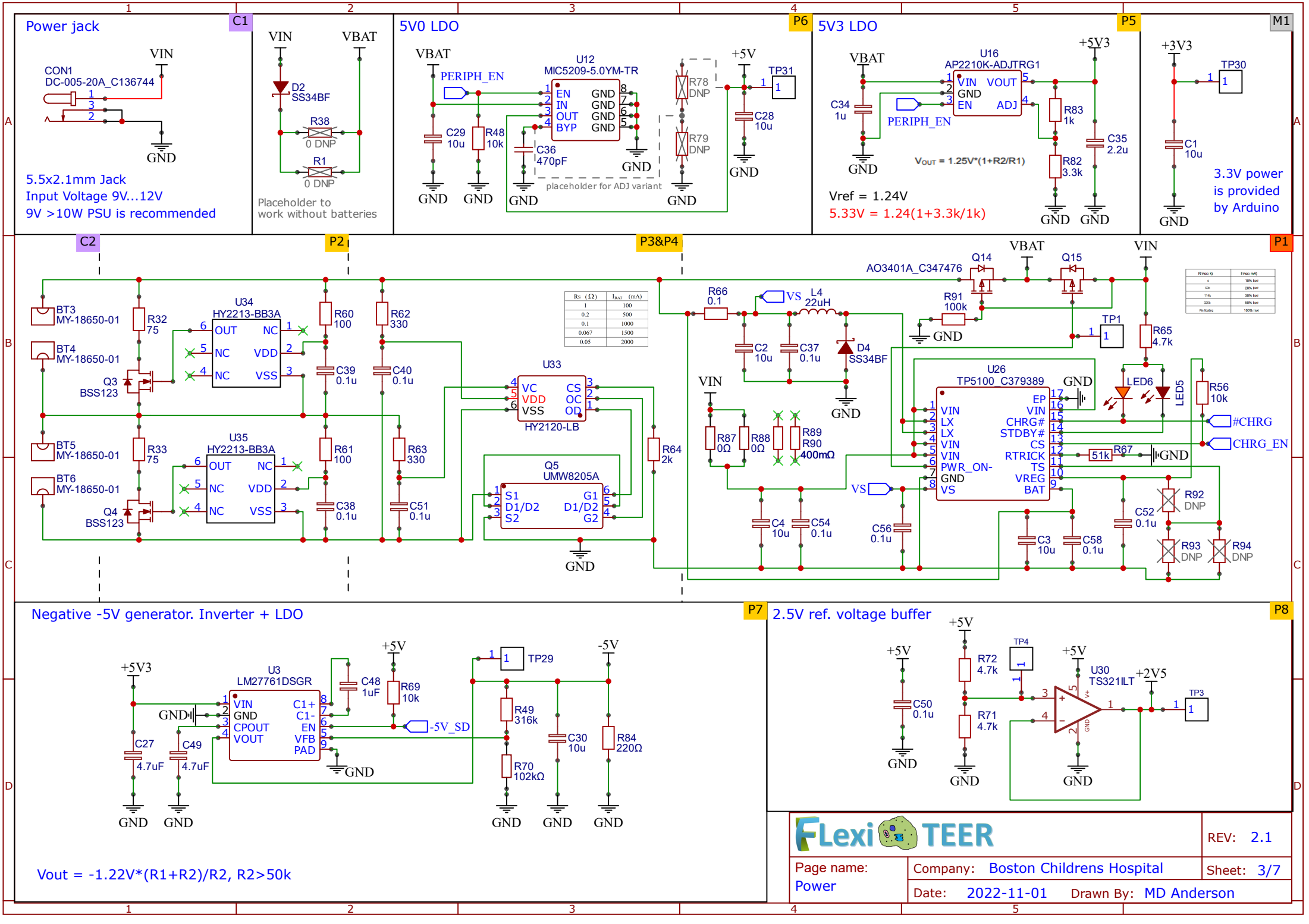
Power jack
C1
CON1
DC-005-20A_C136744
VIN
GND
5.5x2.1mm Jack
Input Voltage 9V...12V
9V >10W PSU is recommended
D2
SS34BF
R38
0 DNP
R1
0 DNP
Placeholder to
work without batteries
5V0 LDO
P6
U12
MIC5209-5.0YM-TR
PERIPH_EN
C29
10u
R48
10k
C36
470pF
placeholder for ADJ variant
R78
DNP
R79
DNP
C28
10u
TP31
5V3 LDO
P5
U16
AP2210K-ADJTRG1
C34
1u
R83
1k
R82
3.3k
C35
2.2u
Vref = 1.24V
5.33V = 1.24(1+3.3k/1k)
M1
TP30
C1
10u
3.3V power
is provided
by Arduino
C2
P2
P3&P4
P1
BT3
MY-18650-01
BT4
MY-18650-01
BT5
MY-18650-01
BT6
MY-18650-01
R32
75
R33
75
Q3
BSS123
Q4
BSS123
U34
HY2213-BB3A
U35
HY2213-BB3A
R60
100
R61
100
R62
330
R63
330
C39
0.1u
C38
0.1u
C40
0.1u
C51
0.1u
U33
HY2120-LB
Q5
UMW8205A
R64
2k
AO3401A_C347476
Q14
Q15
R66
0.1
L4
22uH
D4
SS34BF
C2
10u
C37
0.1u
R91
100k
TP1
R65
4.7k
R87
0Ω
R88
0Ω
R89
R90
400mΩ
U26
TP5100_C379389
LED6
LED5
R56
10k
#CHRG
CHRG_EN
R67
51k
C4
10u
C54
0.1u
C56
0.1u
C3
10u
C58
0.1u
C52
0.1u
R92
DNP
R93
DNP
R94
DNP
Negative -5V generator. Inverter + LDO
P7
U3
LM27761DSGR
C27
4.7uF
C49
4.7uF
C48
1uF
R69
10k
-5V_SD
TP29
R49
316k
R70
102kΩ
C30
10u
R84
220Ω
Vout = -1.22V*(R1+R2)/R2, R2>50k
2.5V ref. voltage buffer
P8
C50
0.1u
R72
4.7k
R71
4.7k
TP4
U30
TS321ILT
+2V5
TP3
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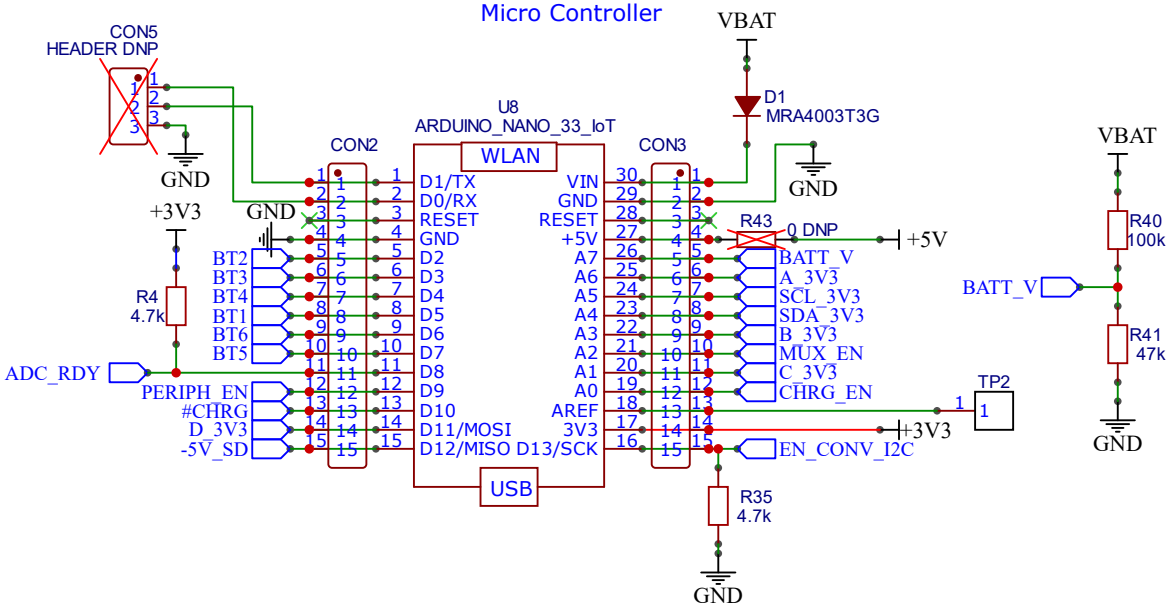
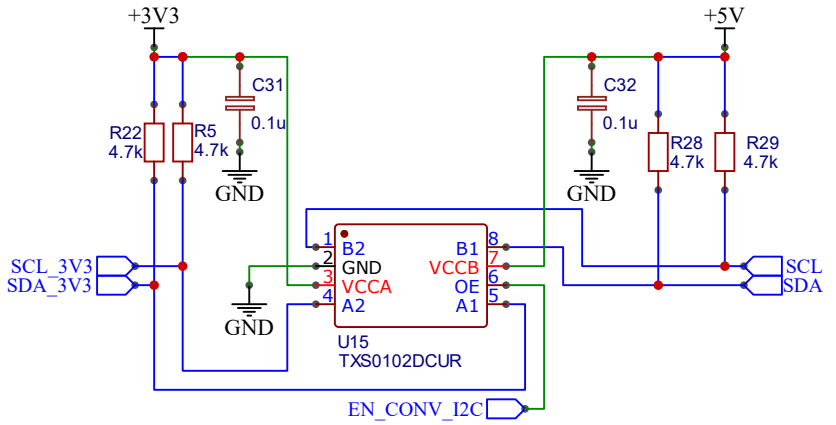
M1

Micro Controller



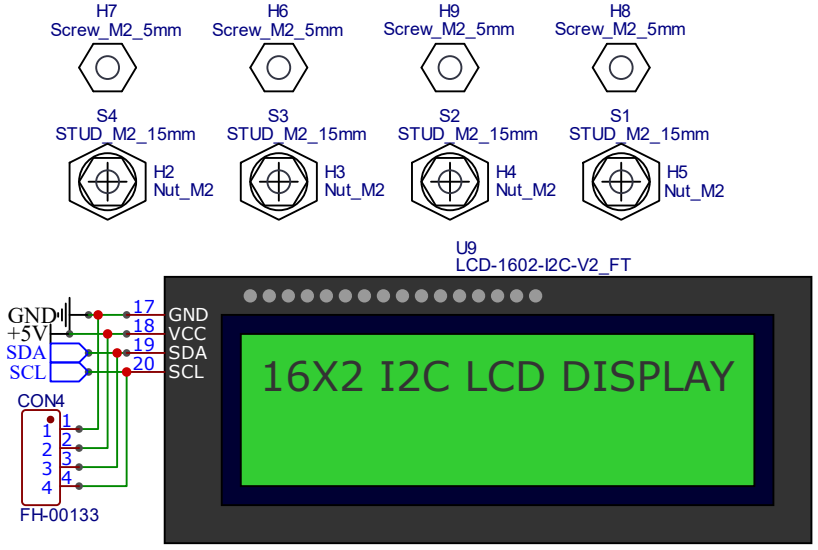
D1

Level translator for I2C 3V3..5V



D2

I2C LCD Panel Connection

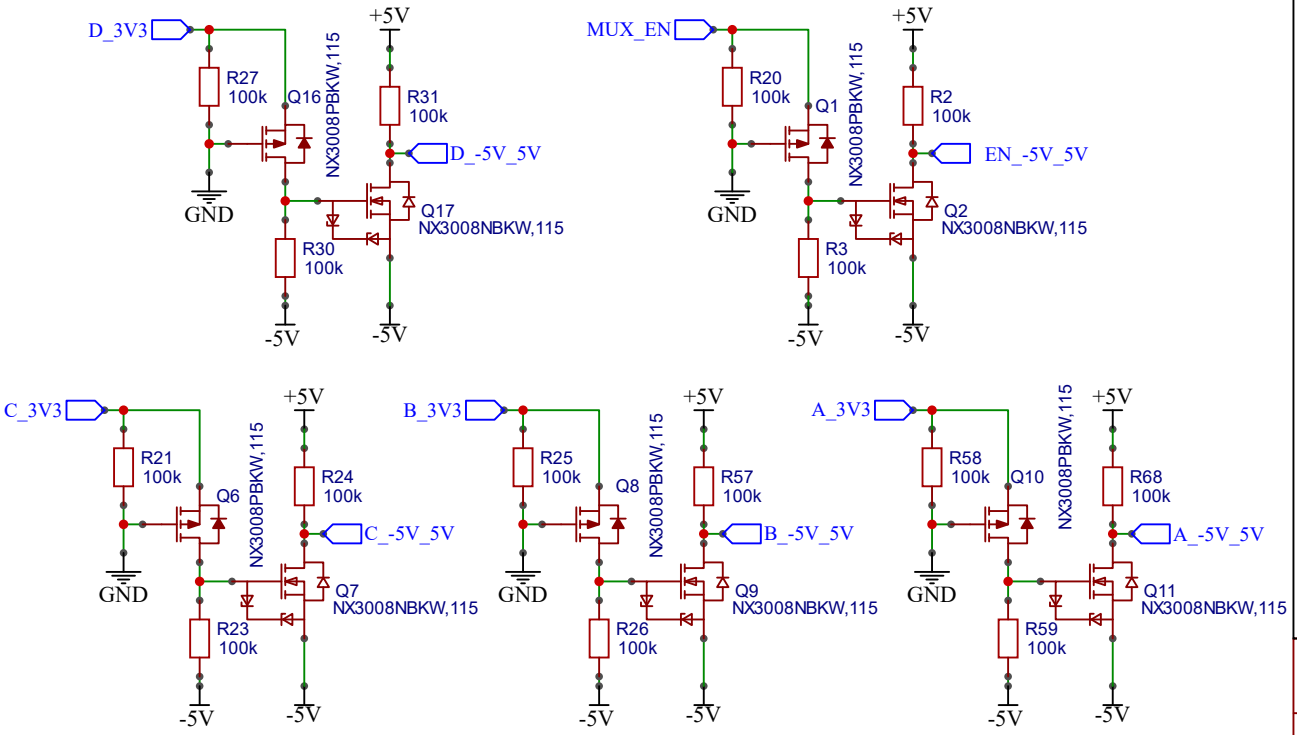


16x2 LCD with pcf8574t expander board
LCD screen can be purchased
with expander board already attached

Default I2C addr 0010 0111(0x27)

D6

Level translator 0..5V to -5V..+5V



https://e2e.ti.com/support/logic-group/logic/f/logic-forum/605766/positive-to-negative-level-shifters

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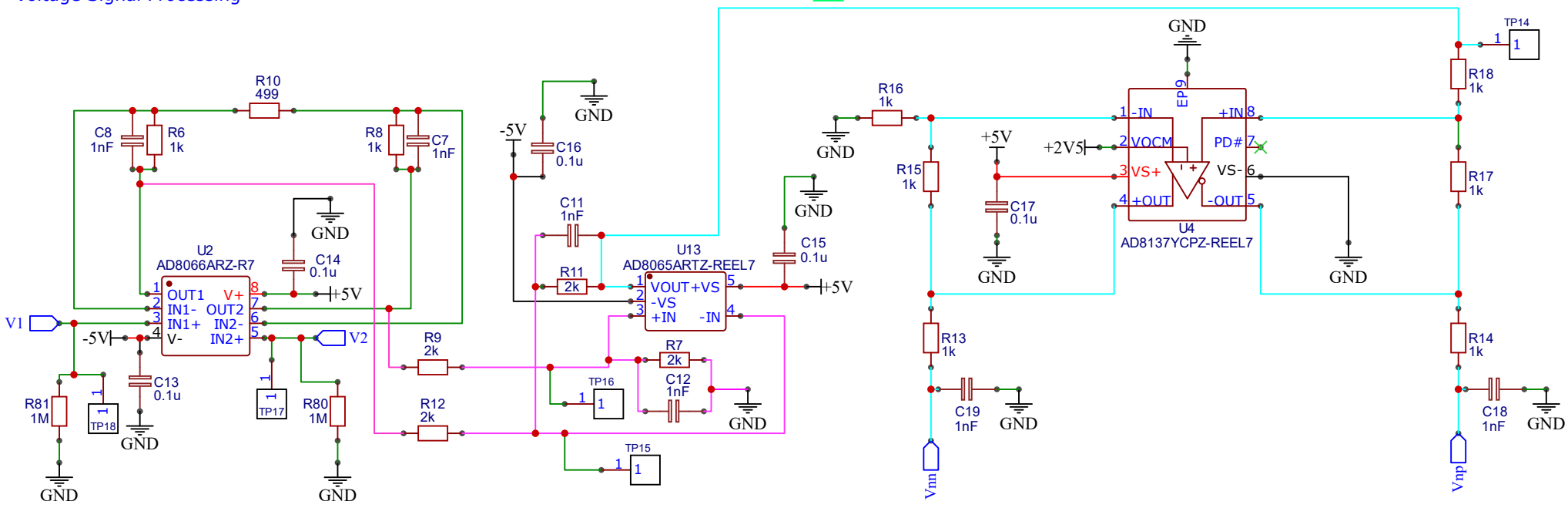
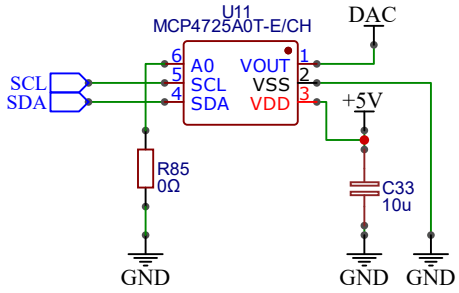
Voltage Signal Processing



DAC



I2C address = 0110 000 (0x60)(A0 state)

ADC

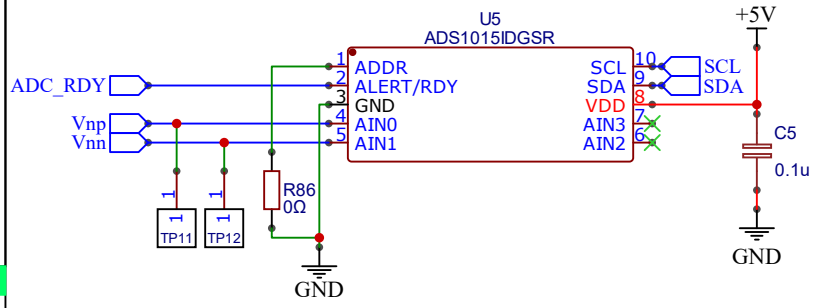
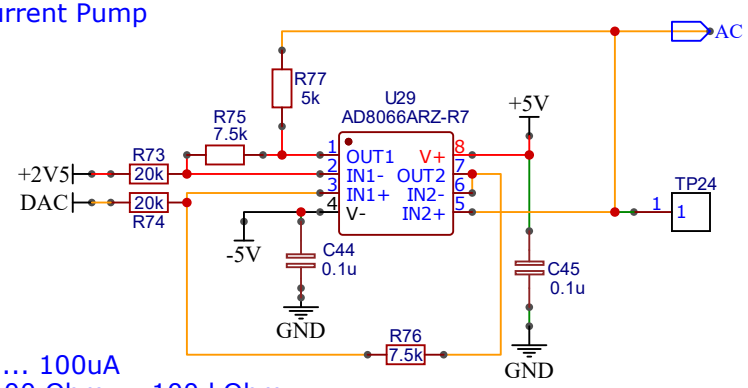


Table 2. ADDR Pin Connection and Corresponding Slave Address

ADDR PIN CONNECTION	SLAVE ADDRESS
GND	1001000
VDD	1001001
SDA	1001010
SCL	1001011

I2C address = 0100 1000 (0x48)

The Howland Current Pump



I range = 10uA ... 100uA
Rload range = 100 Ohm ... 100 kOhm

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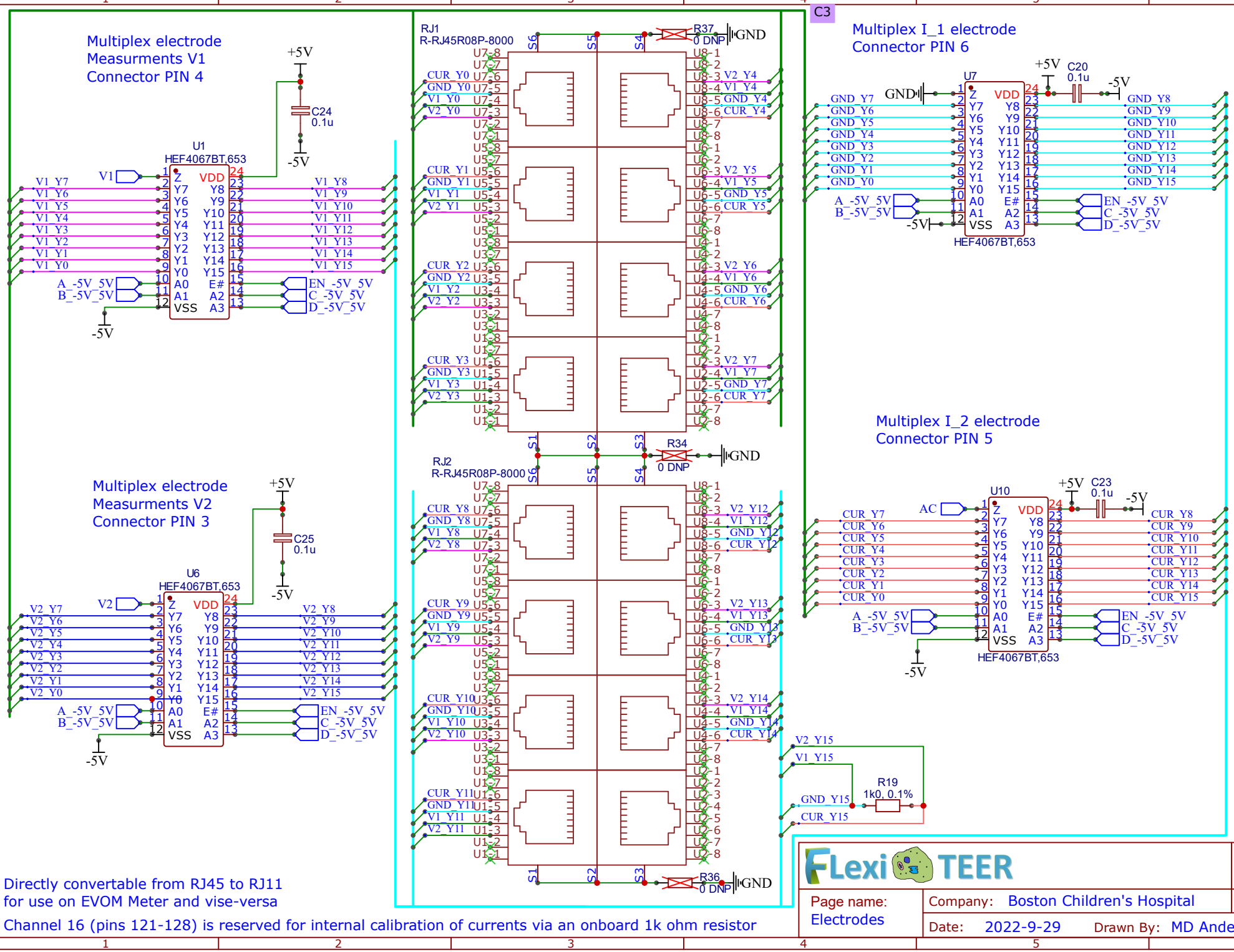
Multiplex electrode
Measurments V1
Connector PIN 4
Multiplex electrode
Measurments V2
Connector PIN 3
Multiplex I_1 electrode
Connector PIN 6
Multiplex I_2 electrode
Connector PIN 5
RJ1
R-RJ45R08P-8000
RJ2
R-RJ45R08P-8000
U1
HEF4067BT,653
U6
HEF4067BT,653
U7
HEF4067BT,653
U10
HEF4067BT,653
C24
0.1u
C25
0.1u
C20
0.1u
C23
0.1u
R37
0 DNP
R34
0 DNP
R36
0 DNP
R19
1k0, 0.1%
+5V
-5V
GND
C3
A3
Directly convertable from RJ45 to RJ11
for use on EVOM Meter and vise-versa
Channel 16 (pins 121-128) is reserved for internal calibration of currents via an onboard 1k ohm resistor
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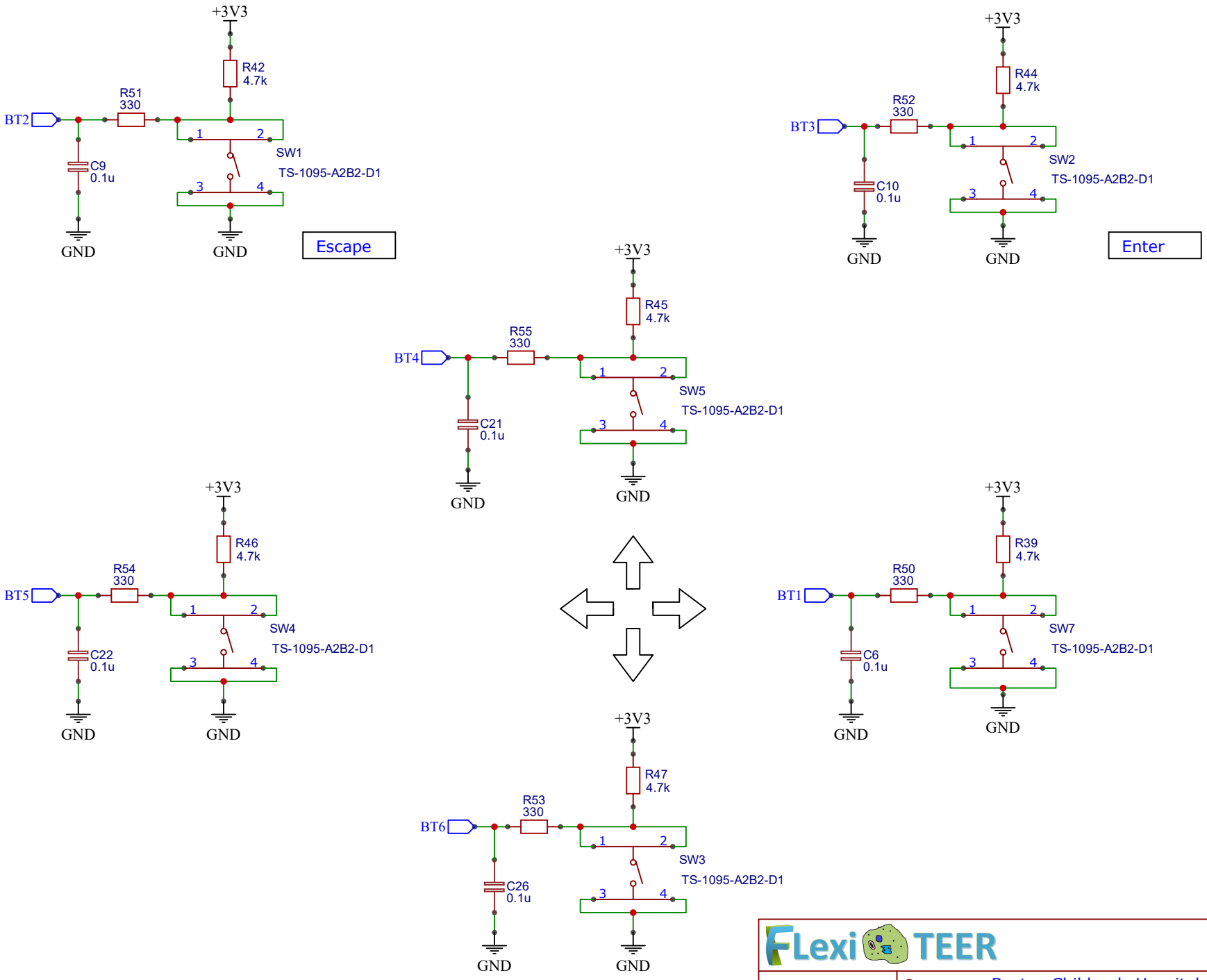
D6
+3V3
R42
4.7k
R51
330
BT2
1
2
SW1
TS-1095-A2B2-D1
3
4
C9
0.1u
GND
GND
Escape
+3V3
R44
4.7k
R52
330
BT3
1
2
SW2
TS-1095-A2B2-D1
3
4
C10
0.1u
GND
GND
Enter
+3V3
R45
4.7k
R55
330
BT4
1
2
SW5
TS-1095-A2B2-D1
3
4
C21
0.1u
GND
GND
+3V3
R46
4.7k
R54
330
BT5
1
2
SW4
TS-1095-A2B2-D1
3
4
C22
0.1u
GND
GND
+3V3
R39
4.7k
R50
330
BT1
1
2
SW7
TS-1095-A2B2-D1
3
4
C6
0.1u
GND
GND
+3V3
R47
4.7k
R53
330
BT6
1
2
SW3
TS-1095-A2B2-D1
3
4
C26
0.1u
GND
GND
FLexi TEER
REV: 2.1
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Buttons
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