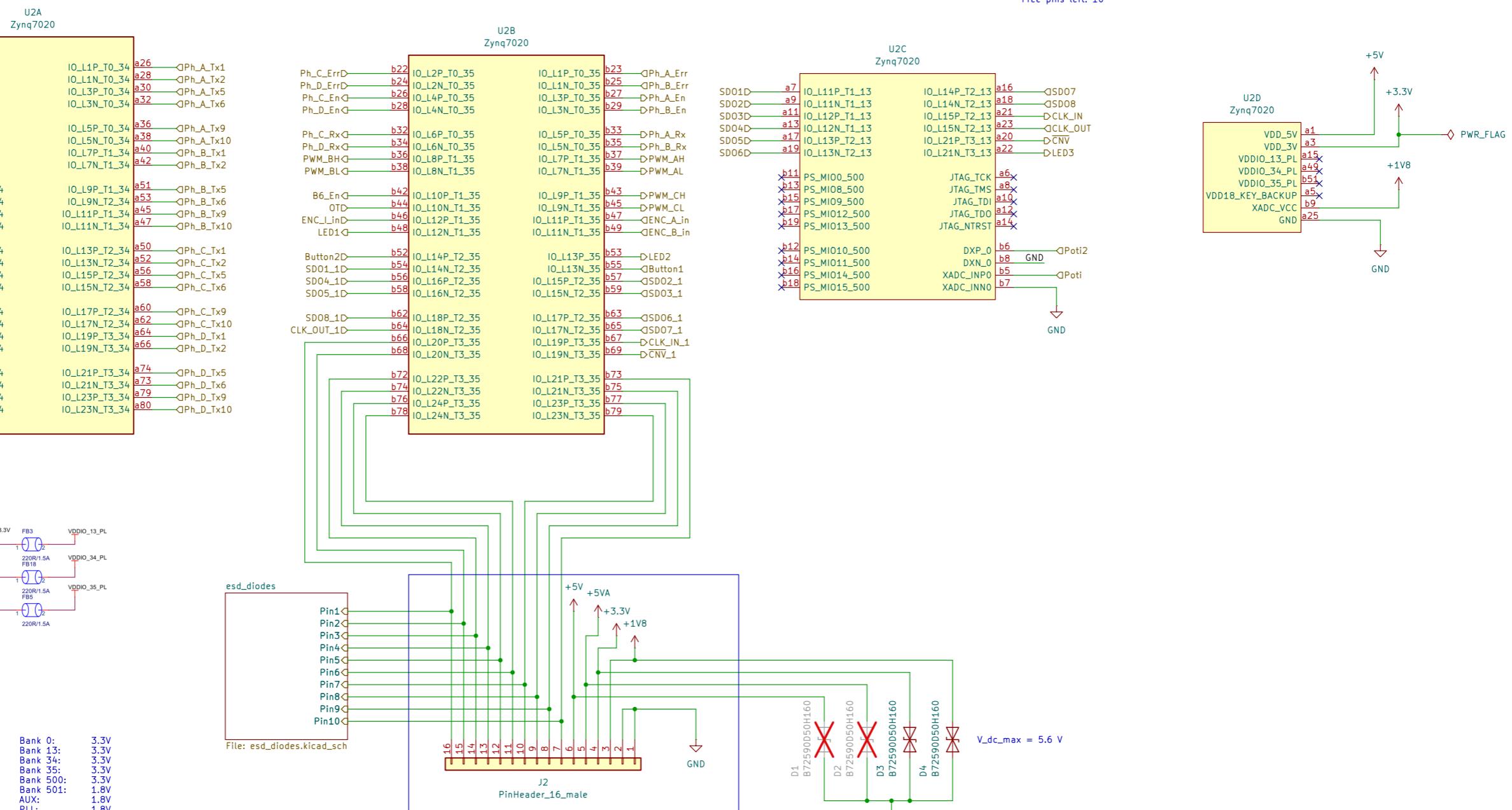


Table 1: Absolute Maximum Ratings<sup>(1)</sup> (Cont'd)

Symbol	Description	Min	Max	Units
$V_{IN}^{(3)(4)(5)}$	I/O input voltage for HR I/O banks	-0.40	$V_{CCO} + 0.55$	V
	I/O input voltage (when $V_{CCO} = 3.3V$ ) for $V_{REF}$ and differential I/O standards except TMDS_33 <sup>(6)</sup>	-0.40	2.625	V
$V_{CCBATT}$	Key memory battery backup supply	-0.5	2.0	V

Bank 13: Total 12 pins -> ADC (11pins)  
 Bank 34: Total 48 pins -> Tx Phase A,B,C,D (48 pins)  
 Bank 35: Total 48 pins -> B6 (8pins) + CHB En/Err/Rx (12pins)  
 + User Interactions (5 pins) + ADC\_Machine (11pin) + encoder (3pins)  
 XADC: 2 Pots

Free pins left: 10

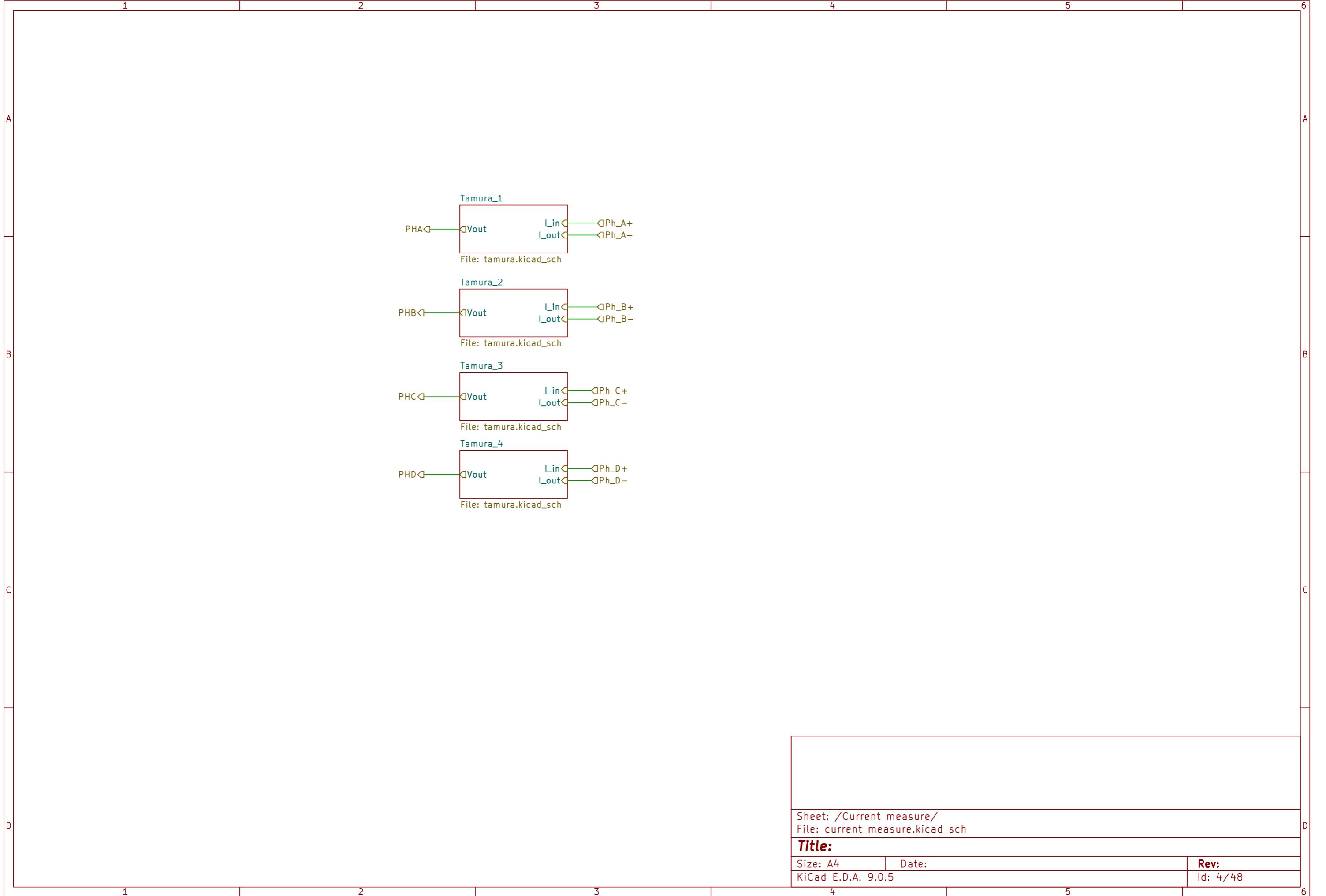


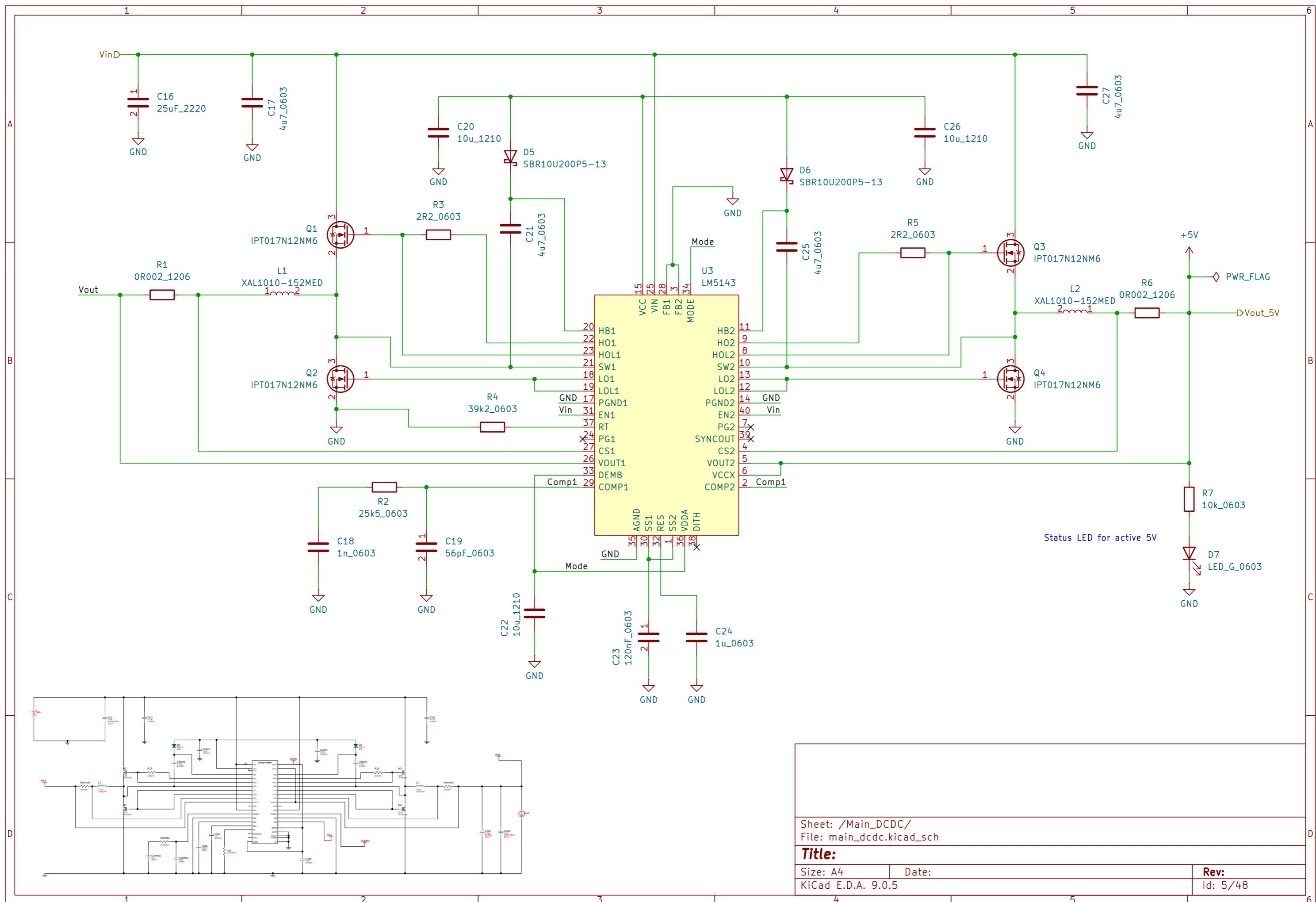
	Min	-	Typ	-	Max
$V_{CCADC}$	XADC supply relative to GNDADC	1.71	1.80	1.89	V
$V_{REFP}$	Externally supplied reference voltage	1.20	1.25	1.30	V

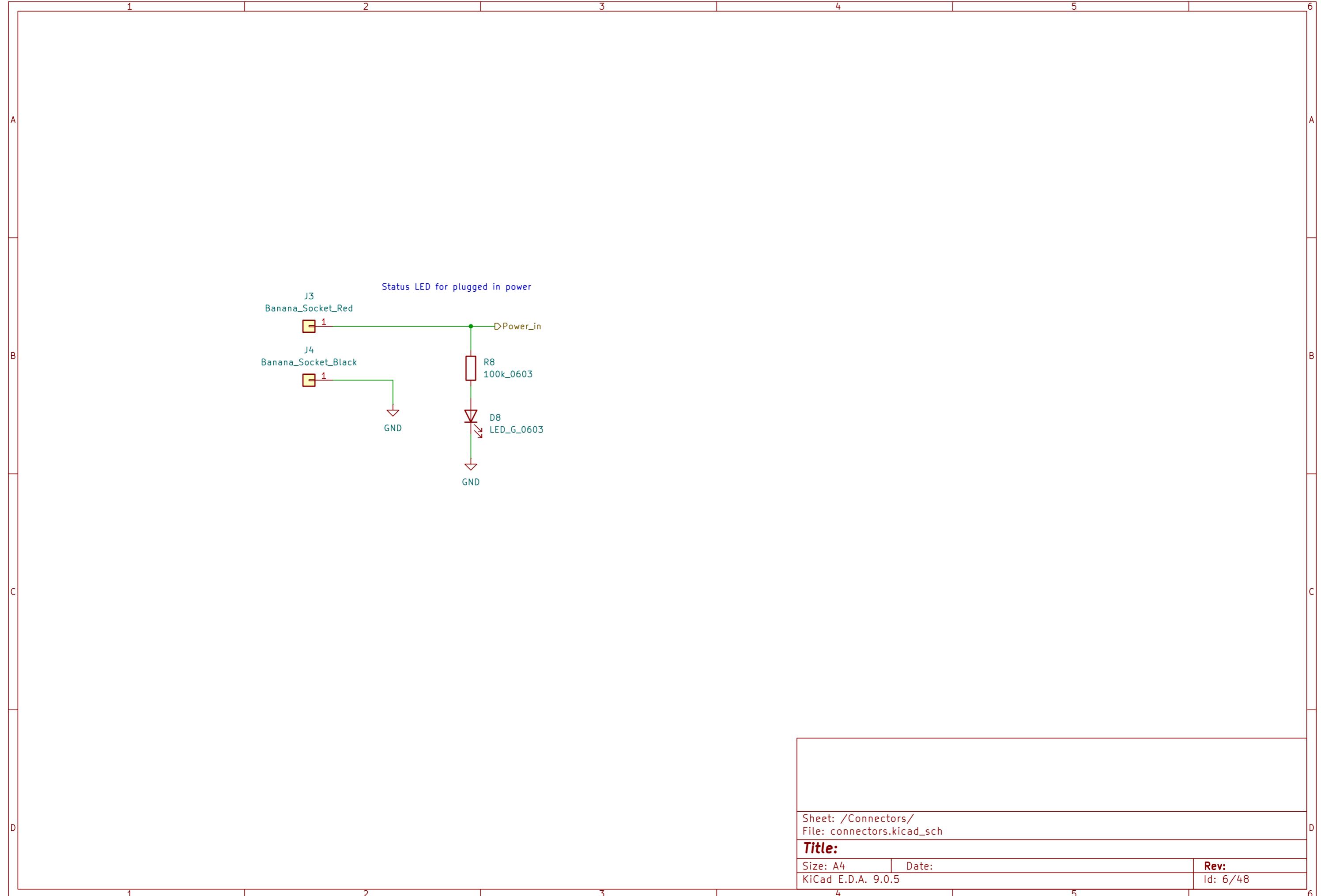
Source: <https://docs.amd.com/v/u/en-US/ds187-XC7Z010-XC7Z020--Data-Sheet>

Sheet: /FPGA/	File: fpga.kicad_sch
<b>Title:</b>	
Size: A3	Date:
KiCad E.D.A. 9.0.5	Rev: Id: 3/48

1 2 3 4 5 6







1 2 3 4 5 6

A

A

B

B

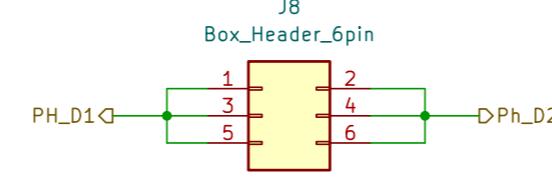
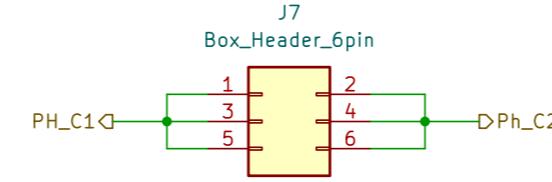
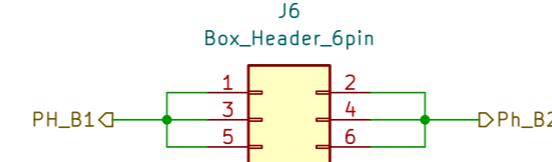
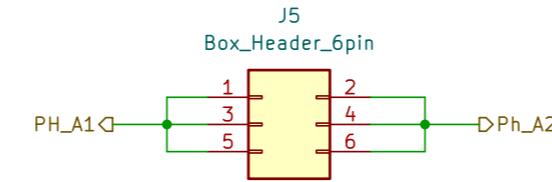
C

C

D

D

Wannenstecker für CHB outputs



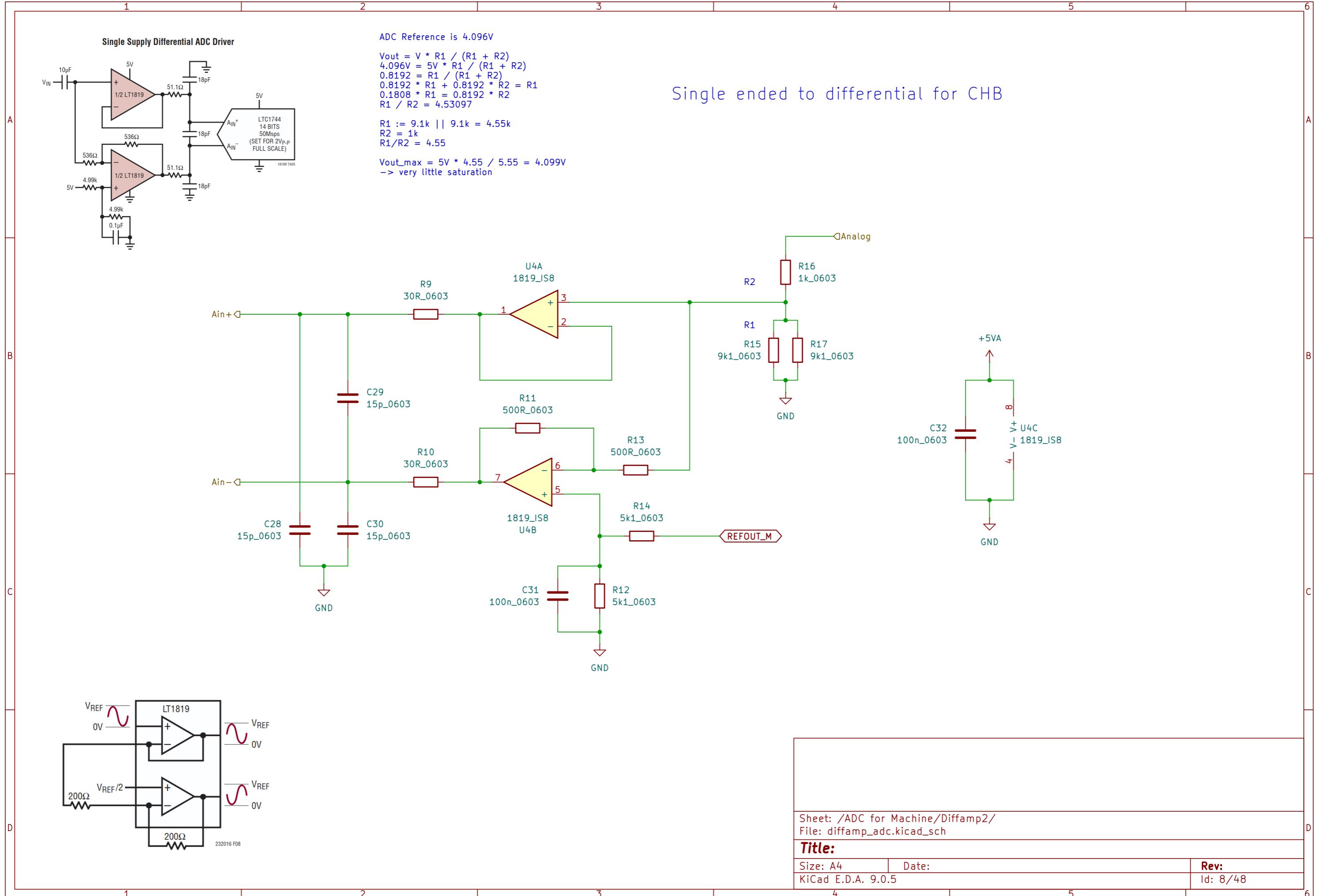
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File: power\_from\_chb.kicad\_sch

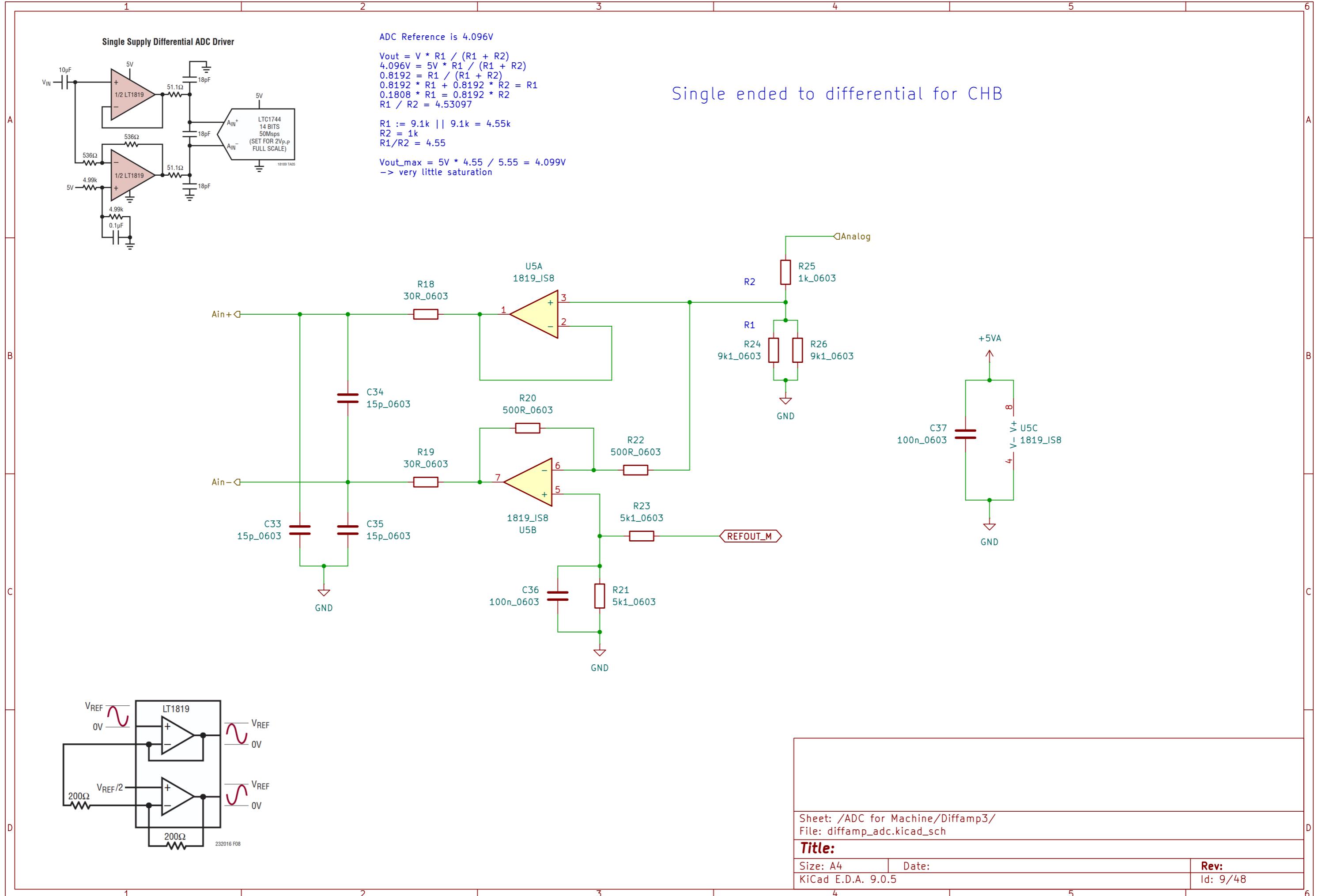
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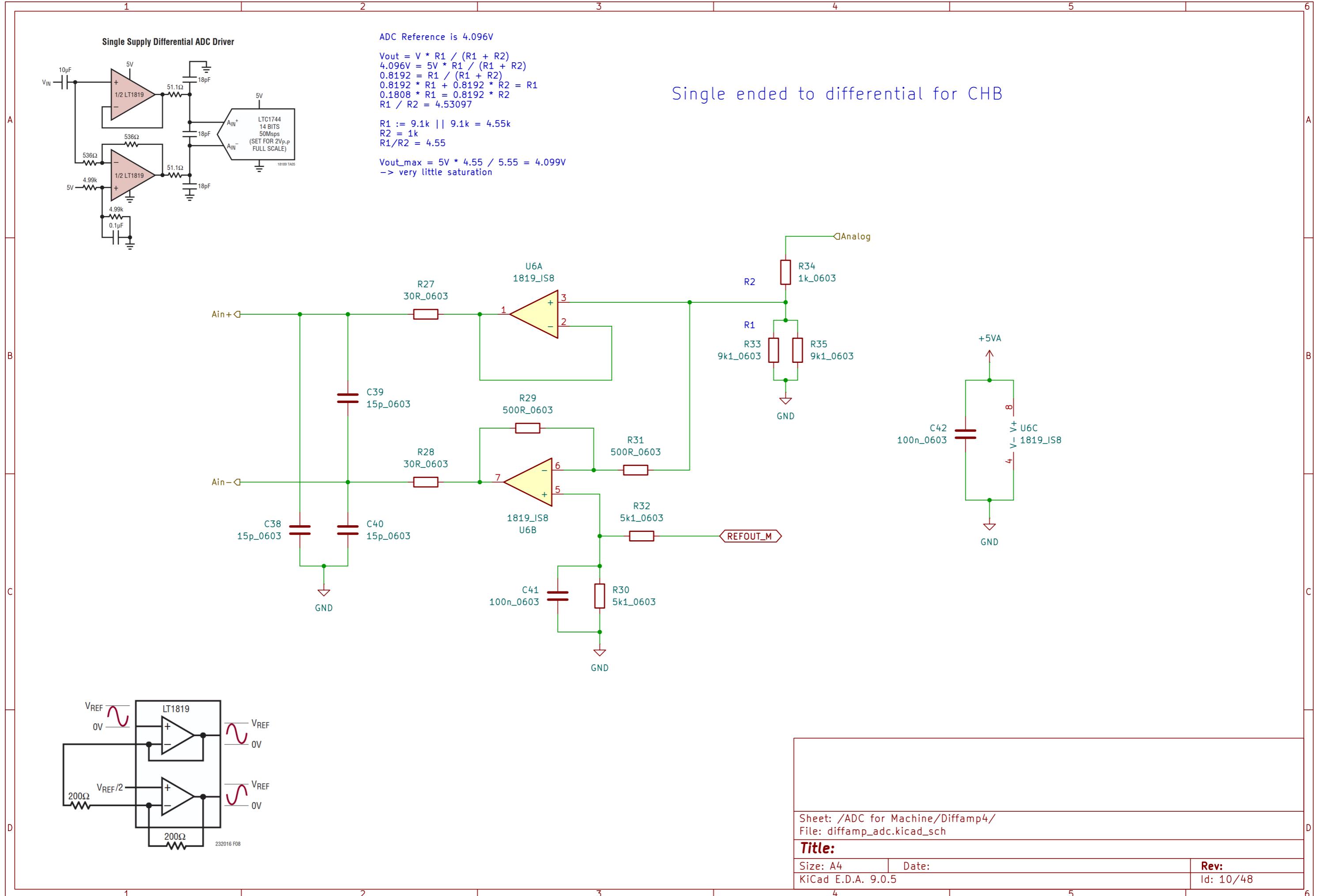
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KiCad E.D.A. 9.0.5

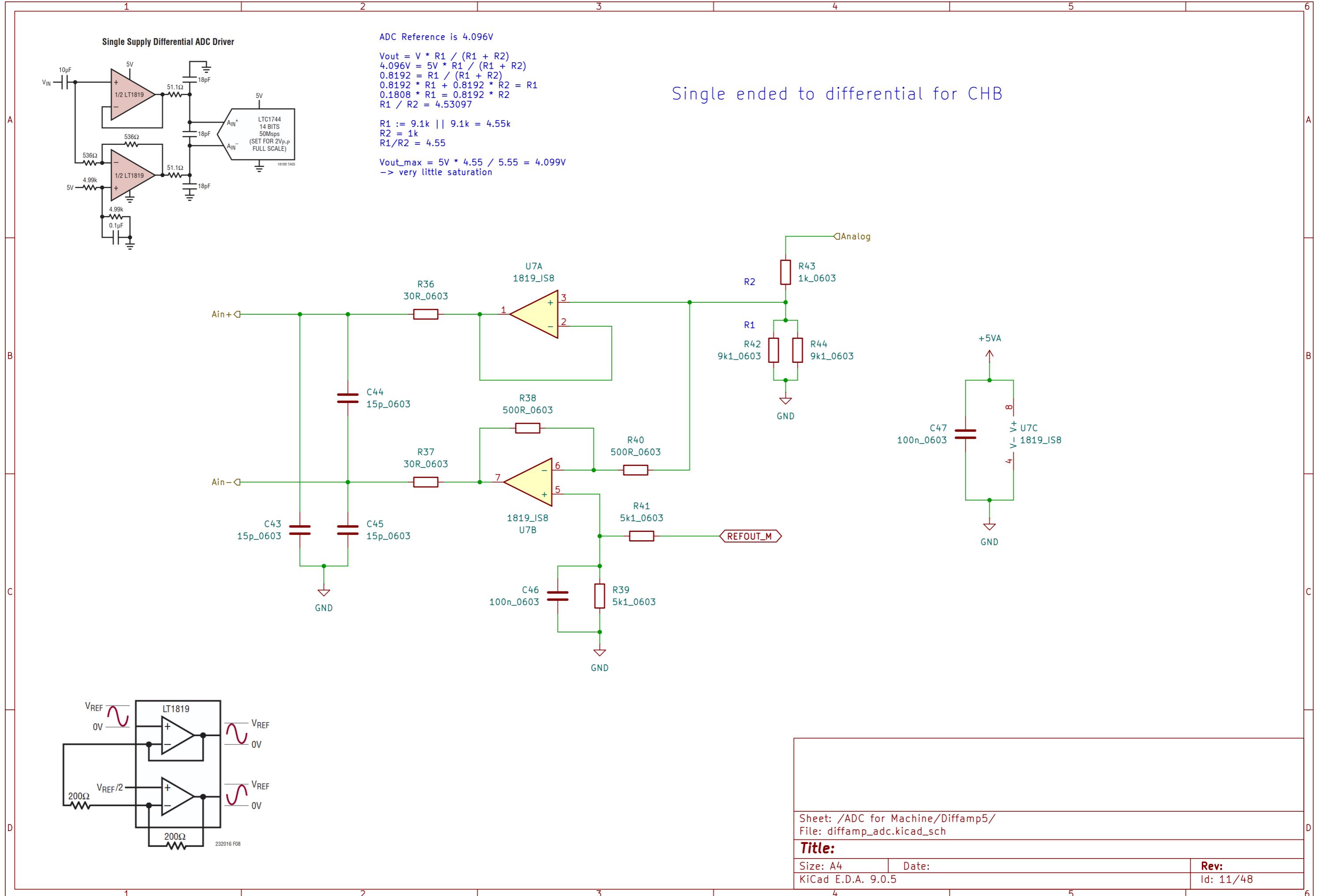
Rev:  
Id: 7/48

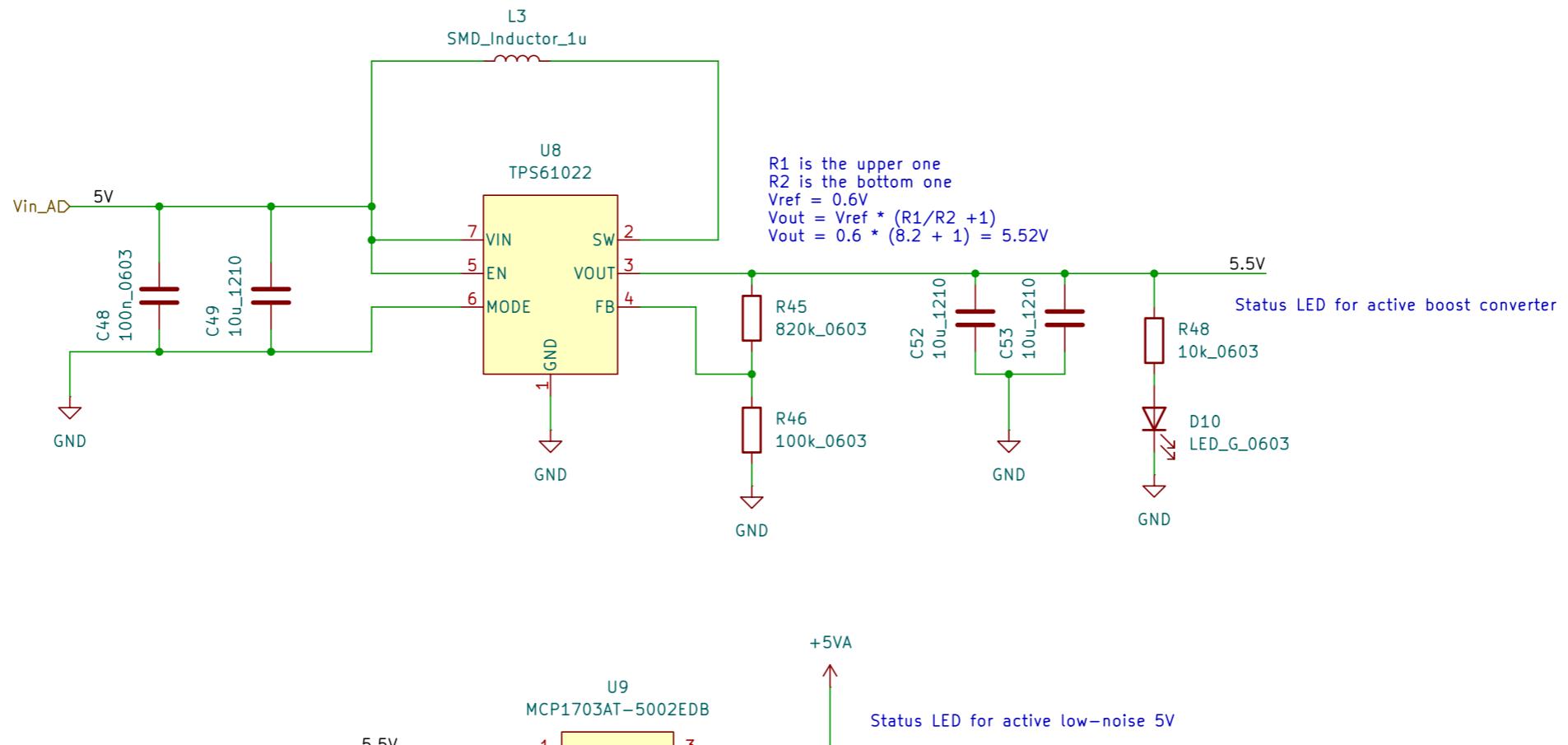
1 2 3 4 5 6











Driven loads:  
 - Tamura Current Sensor  
 (4x, typ:12.5mA, max:37.5mA)  
 - HV-Probe (4x, (TLV197 typ:1mA))  
 - ADC (2x, typ: 31mA)  
 - OpAmp for ADC (16x, Typ:9mA)  
 - Potentiometer (2x, max:1.5mA)

Sum: 50mA – 150mA  
 Maximal Current: 4mA  
 263mA – 363mA  
 62mA  
 144mA  
 3mA

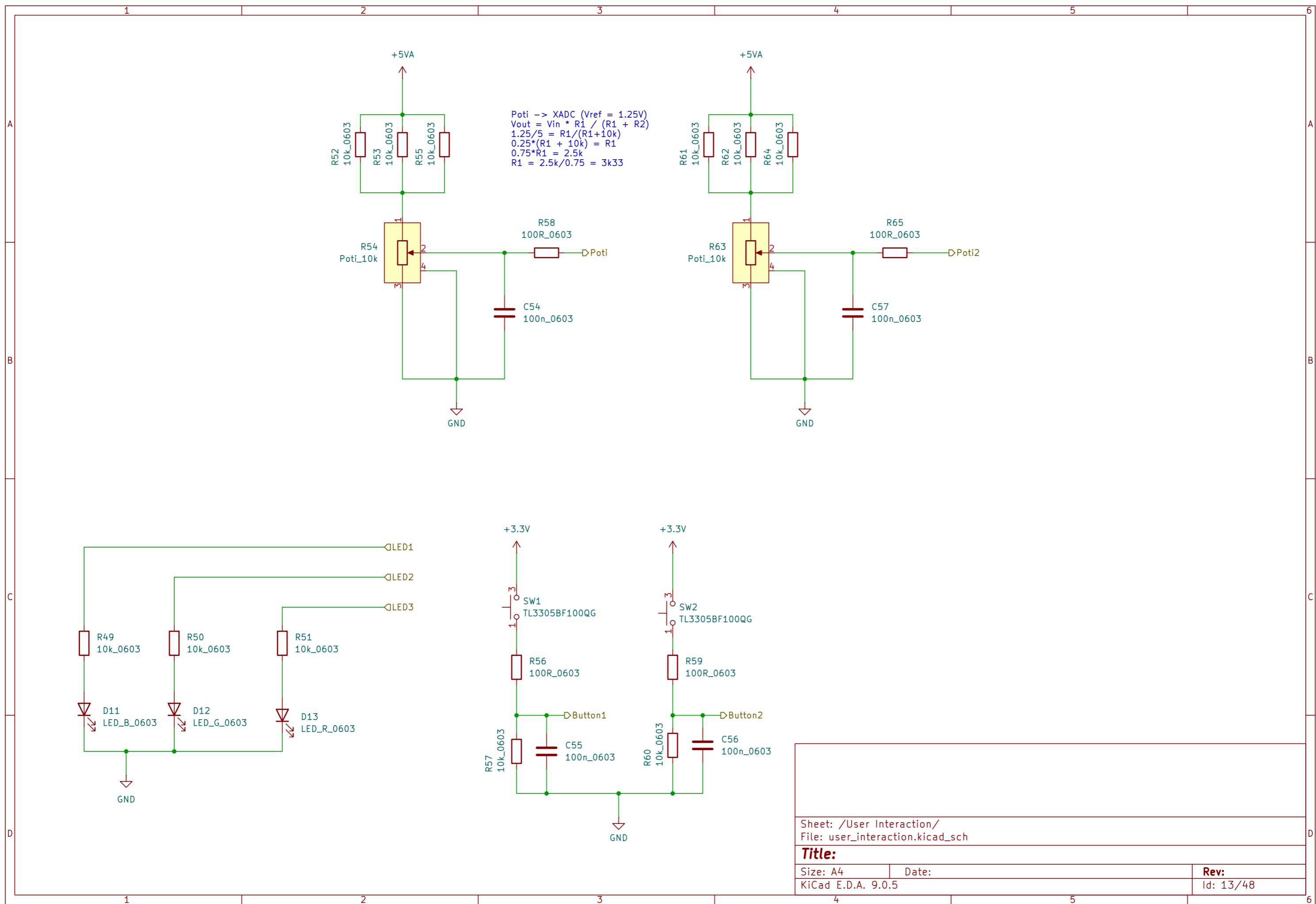
Frage: sollte der Tamura auch von 5VA versorgt werden?

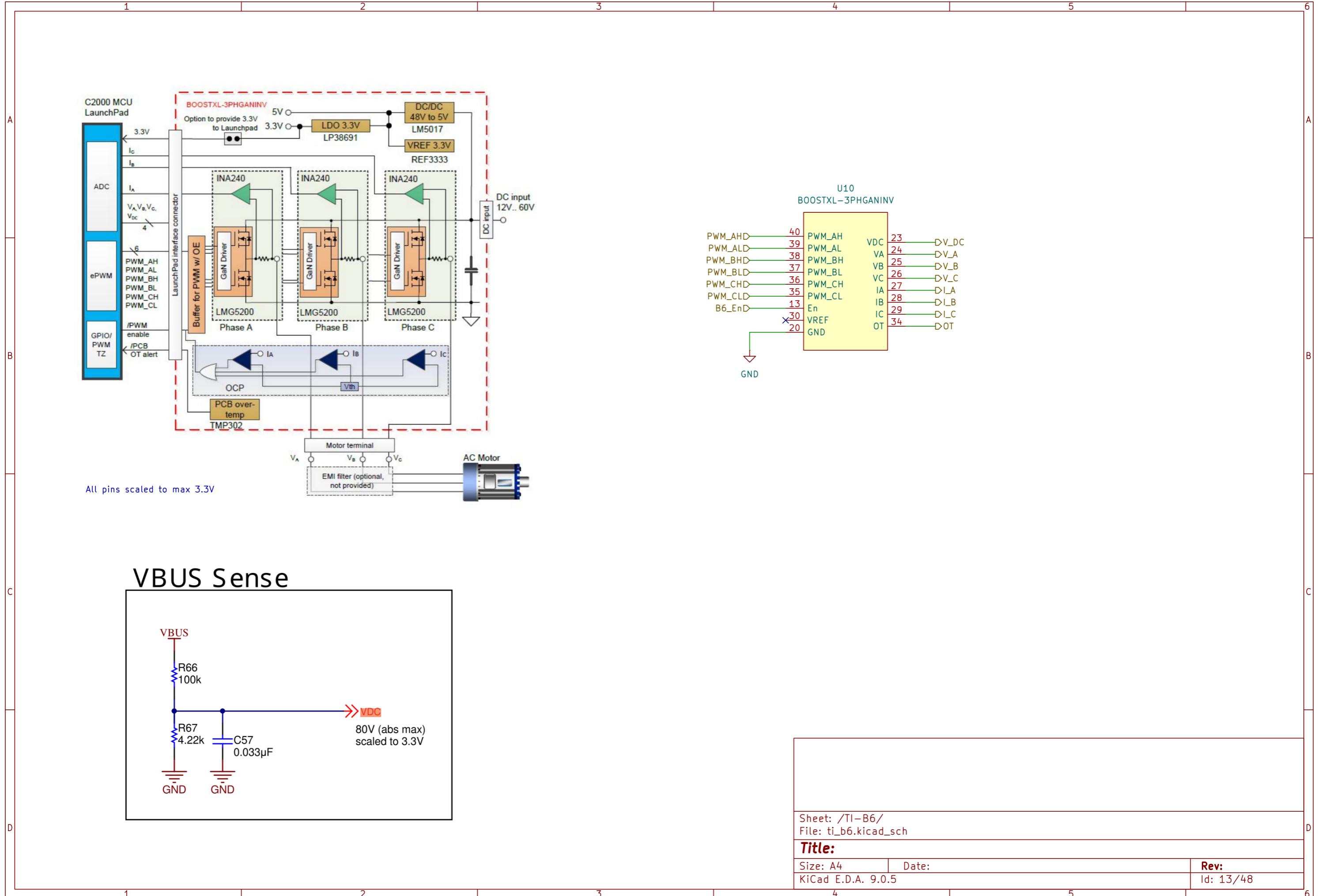
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File: analog\_voltage.kicad\_sch

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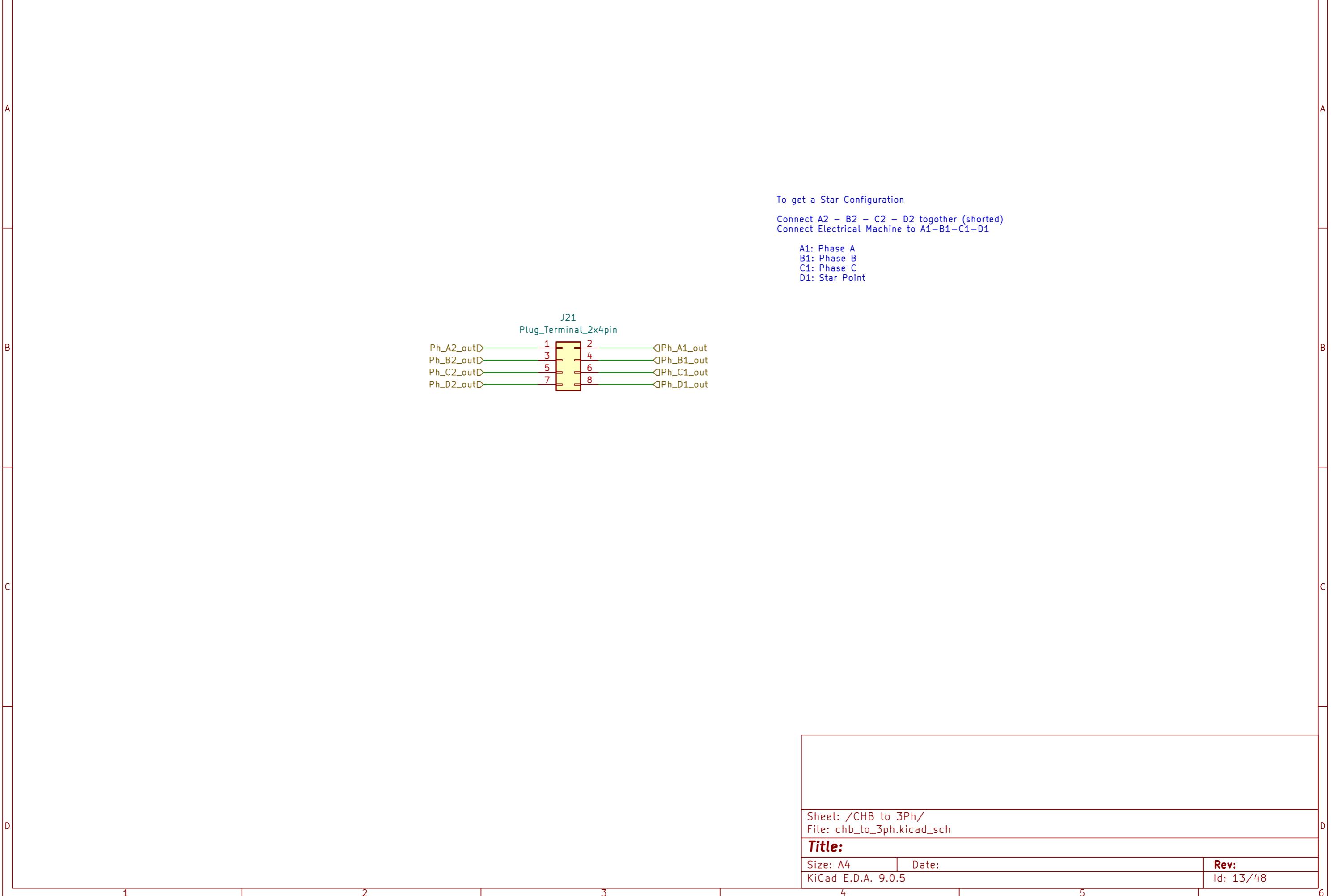
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KiCad E.D.A. 9.0.5

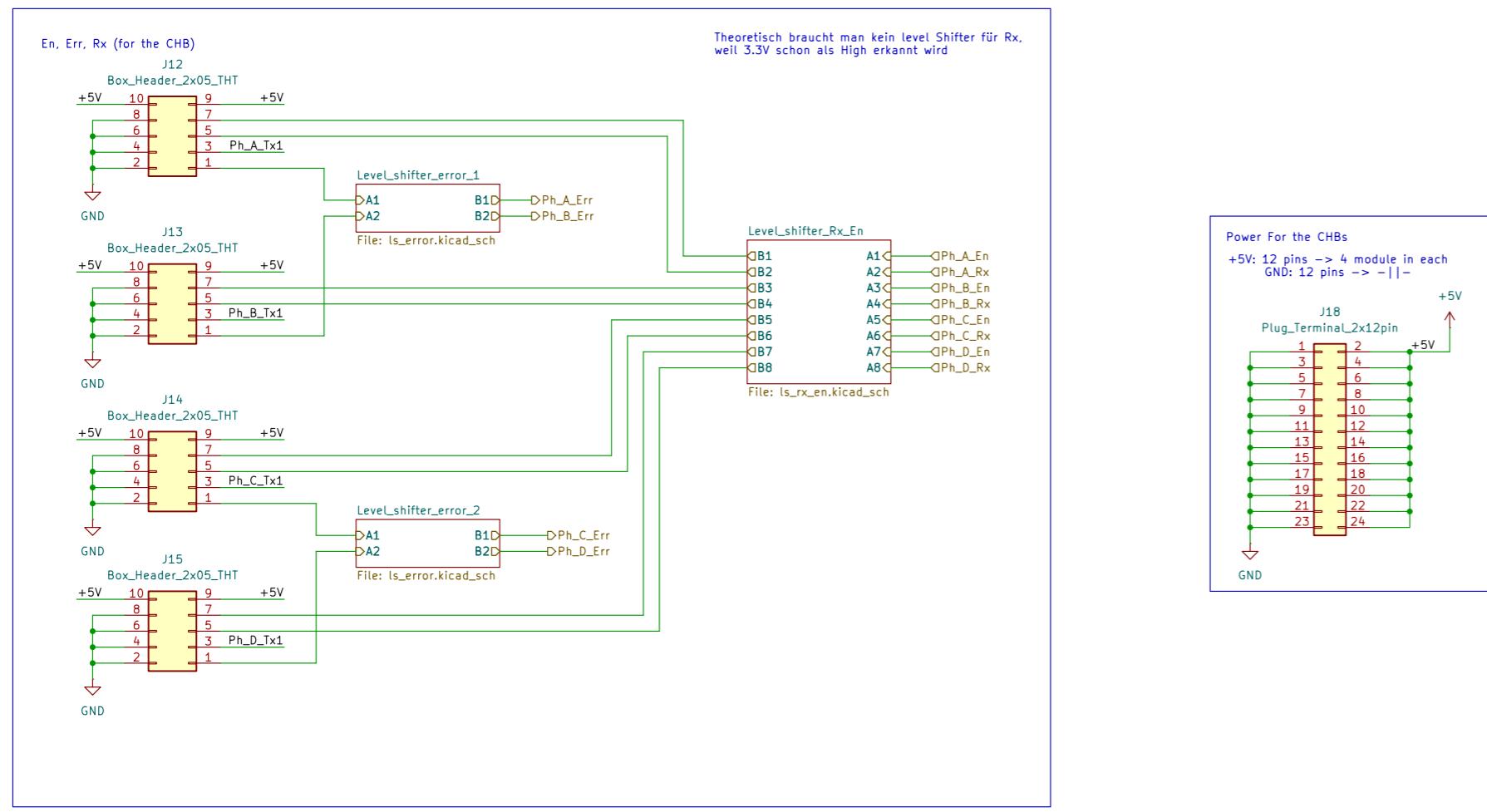
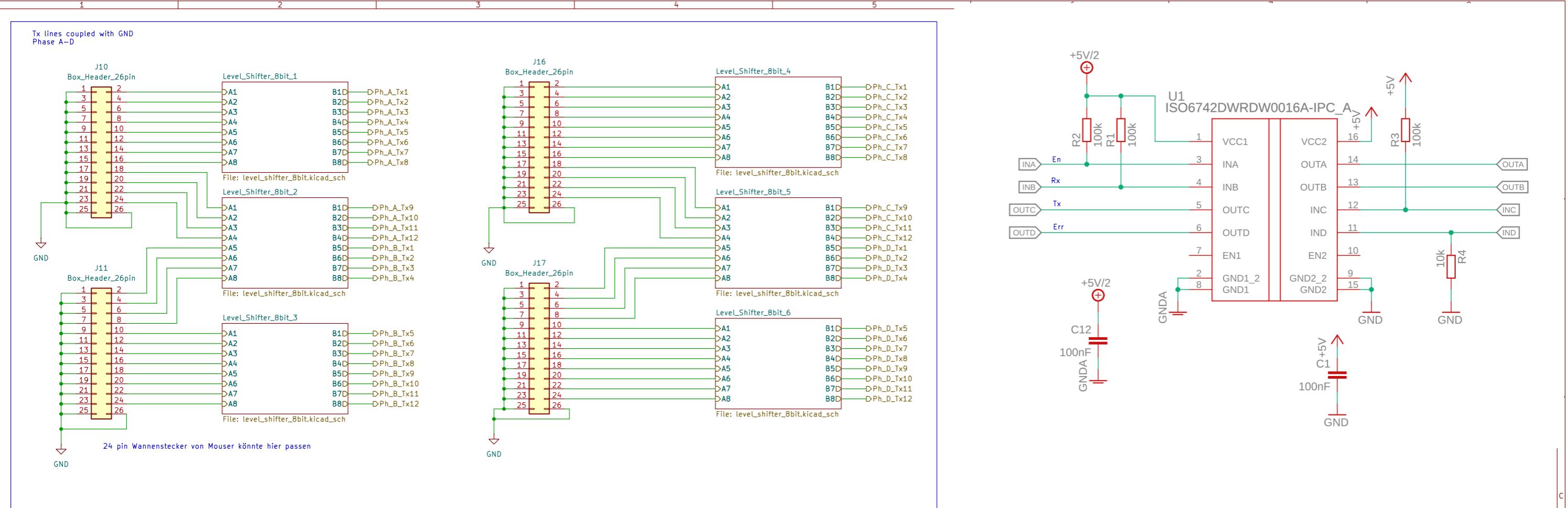
Rev:  
Id: 12/48





1 2 3 4 5 6





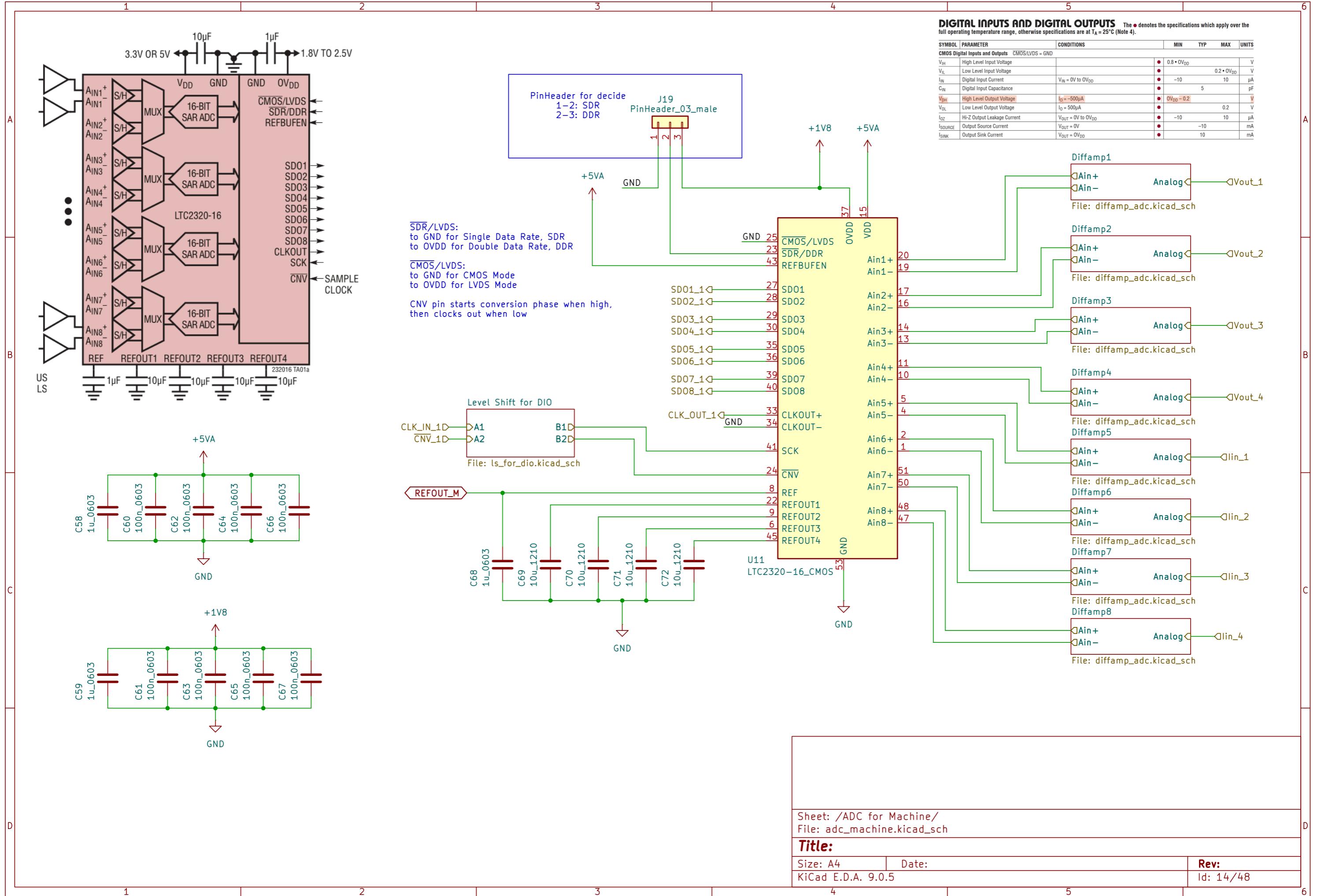
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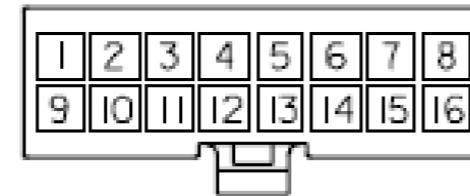
Size: A3 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 14/48



1 2 3 4 5 6

## Molex® Mini-Fit Jr.™



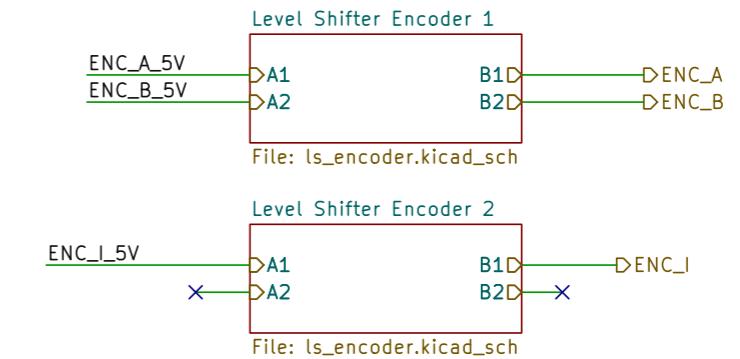
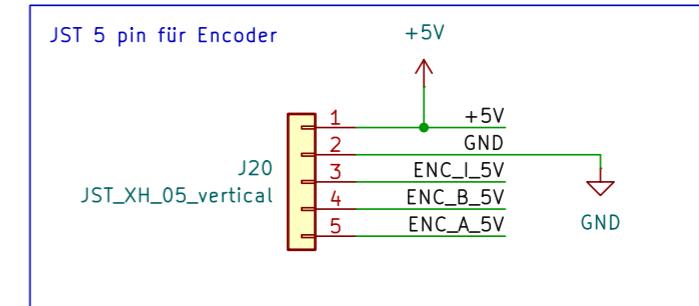
(Wire Entry View)

Mating Housing P/N: 39-01-2161  
 Mating (Male) Contact P/N: 39-00-0049 (24 AWG) 39-00-0082 (16 AWG)  
 Crimp Tool P/N: 11-01-0198

Pin	Color	Signal	Pin	Color	Signal
1	DRAIN x3	P DRAIN	9	16AWG BLK	PHASE R
2	N/A	N/A	10	16AWG RED	PHASE S
3	GRN	COMM S-T	11	16AWG WHT	PHASE T
4	GRN/WHT	COMM R-S	12	RED	+5VDC IN
5	GRY/WHT	COMM T-R	13	BRN	ENC I
6	DRAIN x1	E DRAIN	14	ORN	ENC B
7	BLK	GND	15	BLU	ENC A
8*	BLU/WHT	ENC A~	16*	ORN/WHT	ENC B~

\* Although all terminals in the connector are populated, this signal complement is available only in motor models configured with a differential encoder

(The encoder is not Differential)



Sheet: /Encoder/  
 File: encoder.kicad\_sch

### Title:

Size: A4 Date:

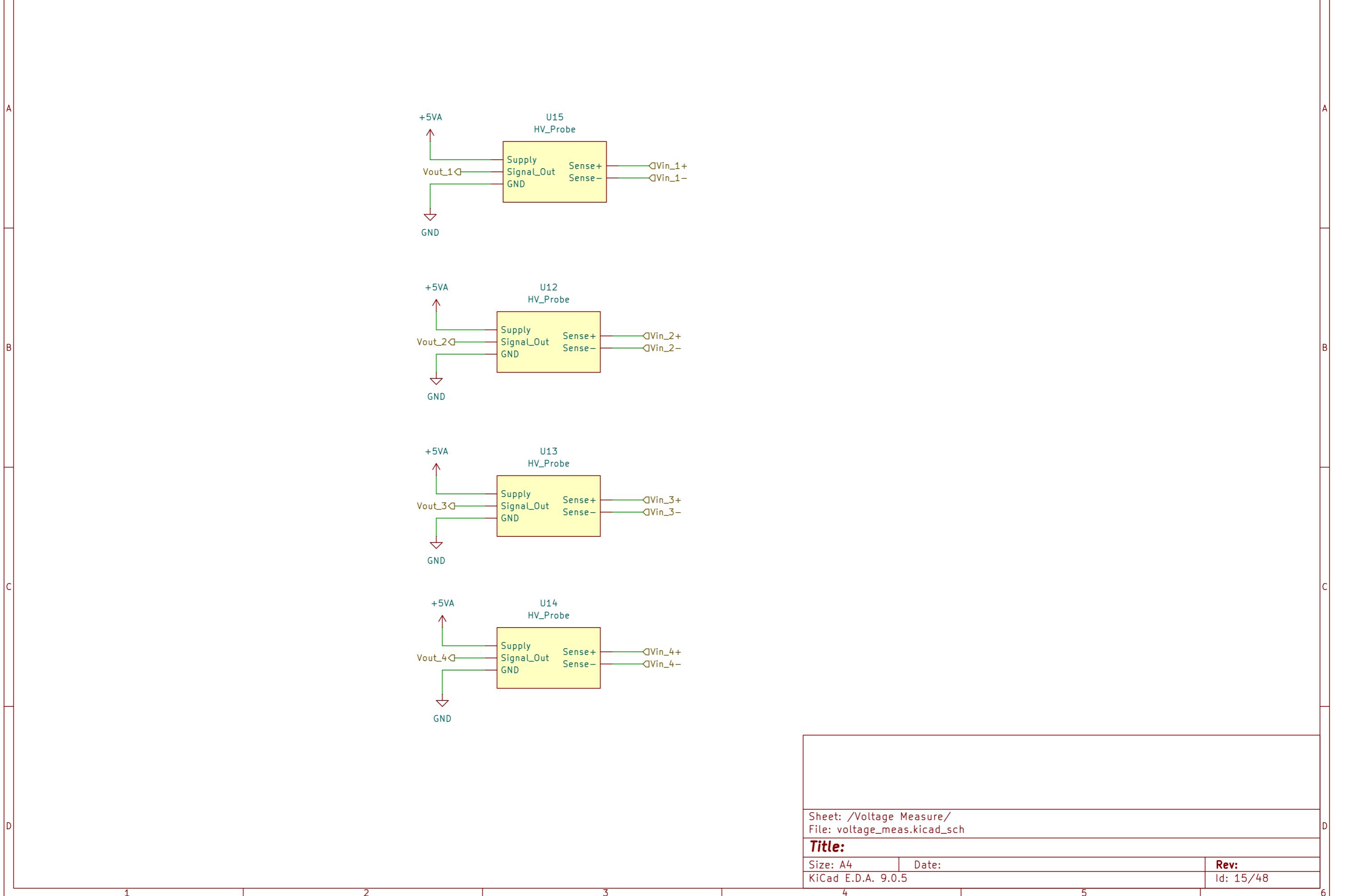
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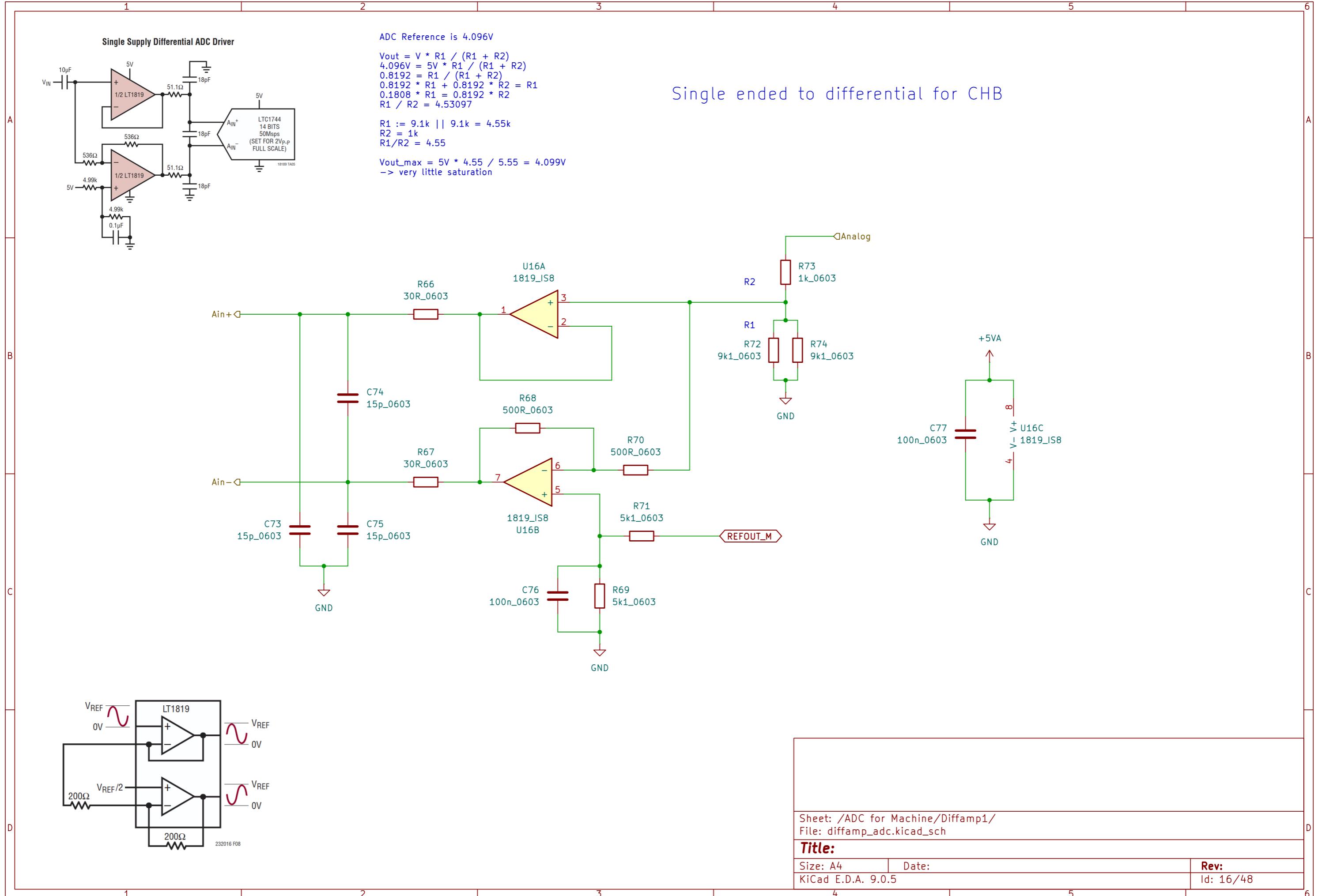
Rev:

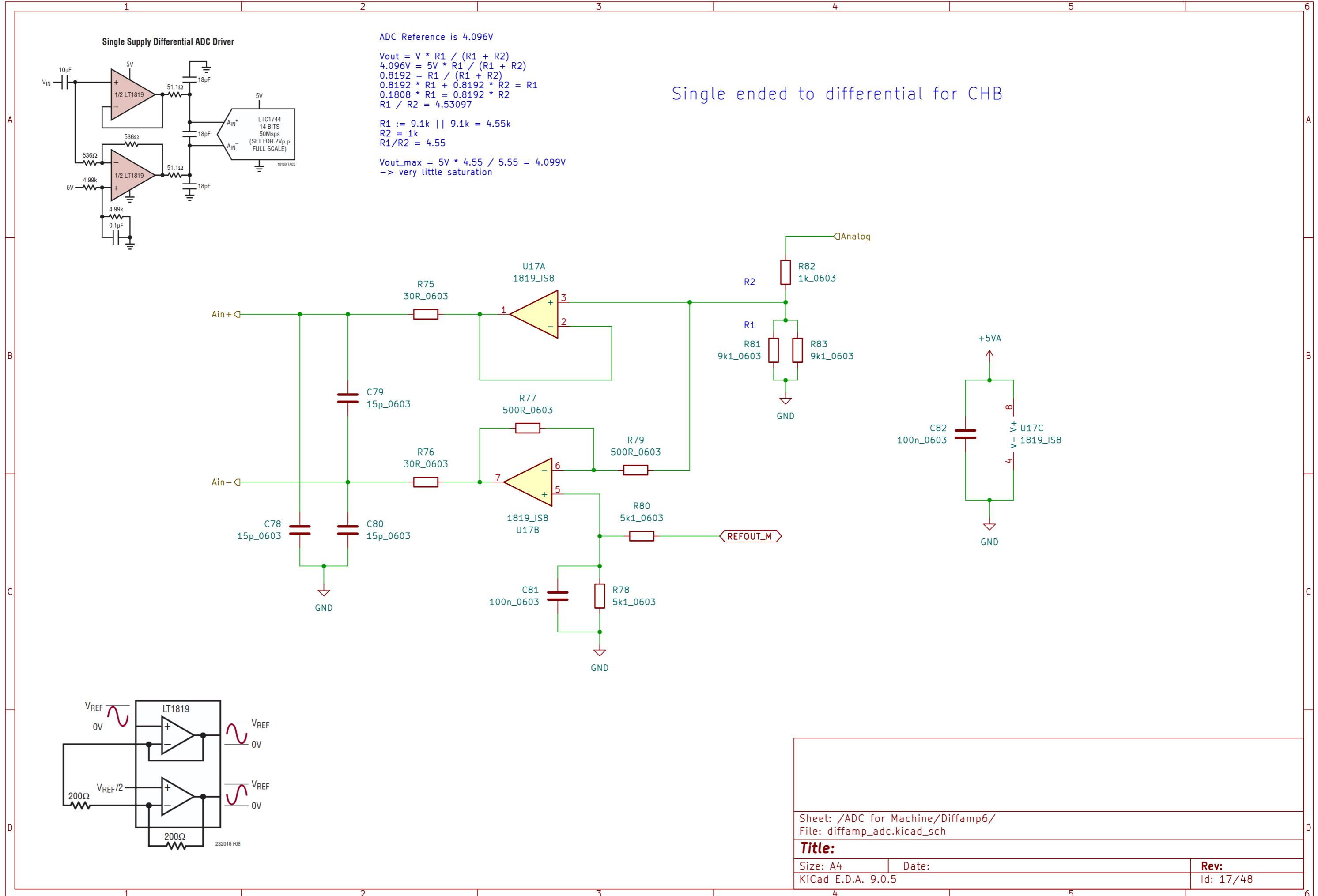
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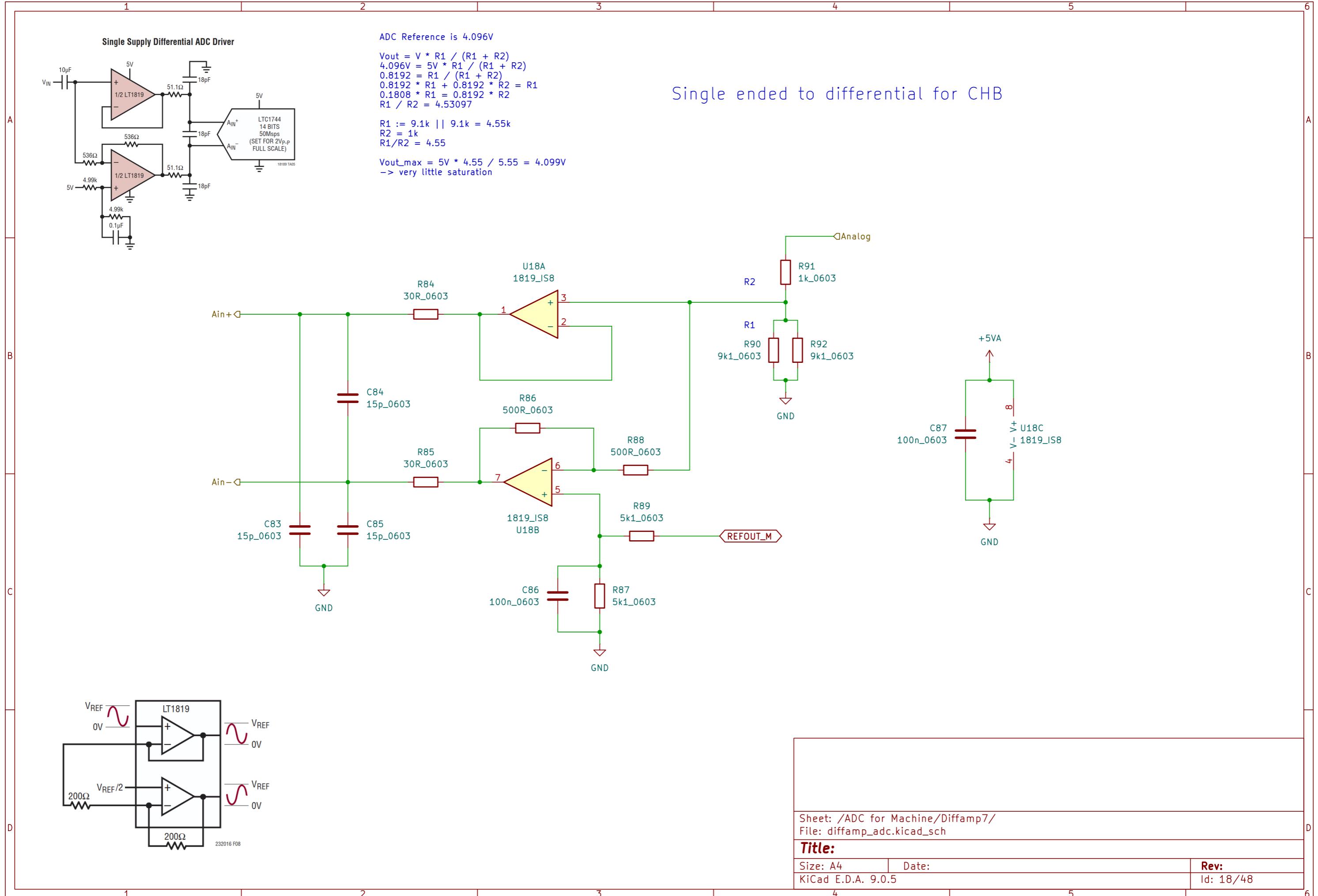
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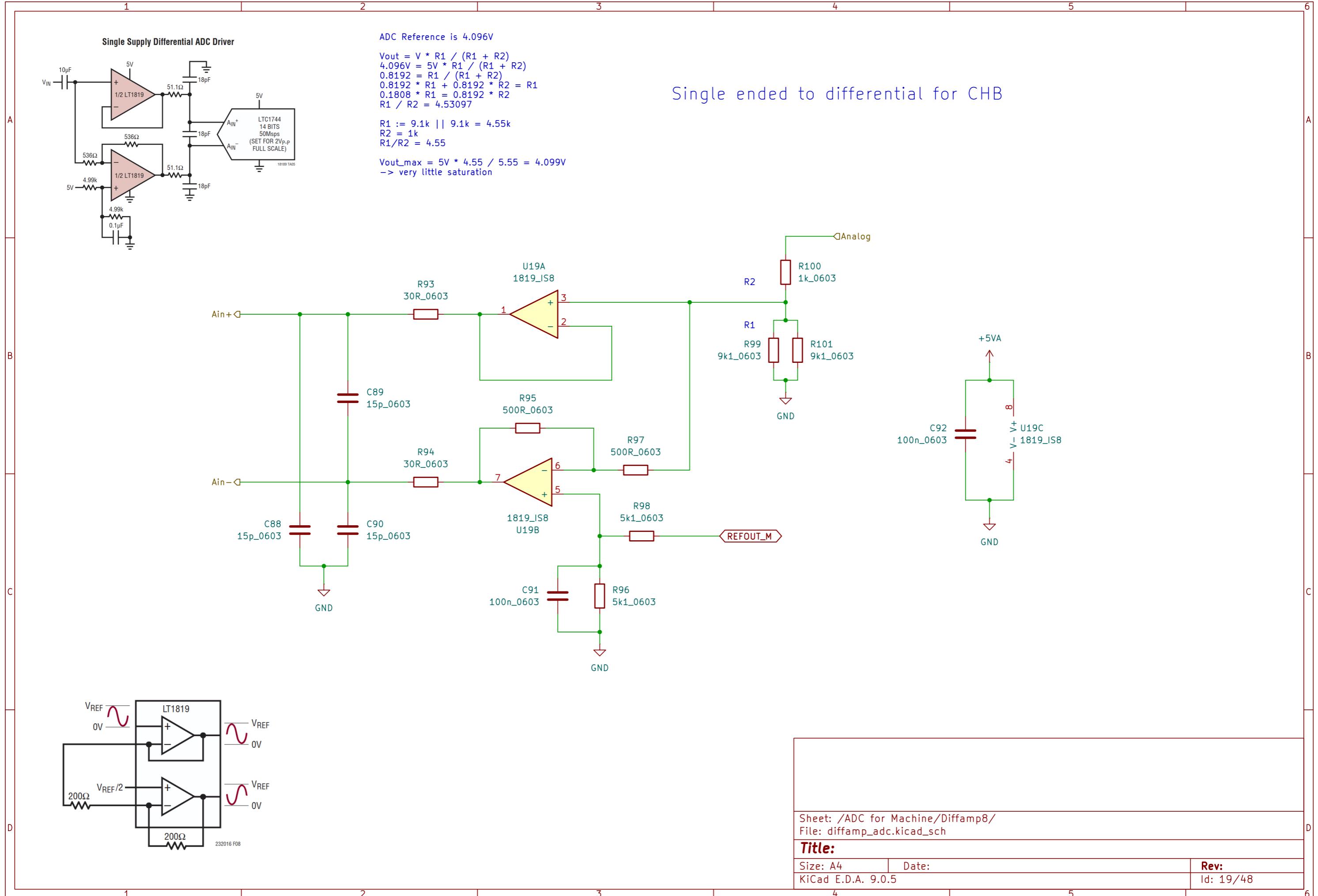
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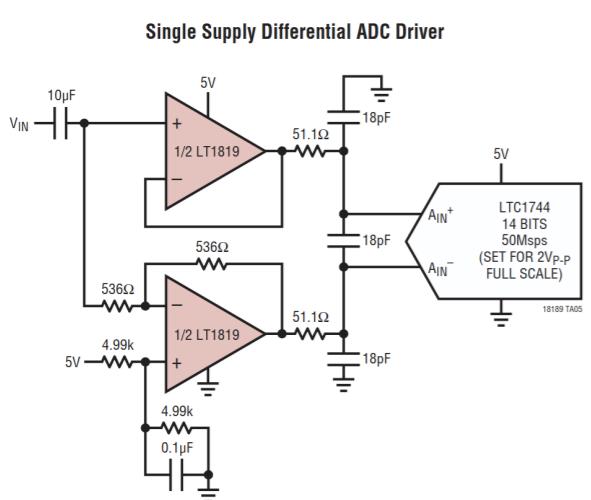




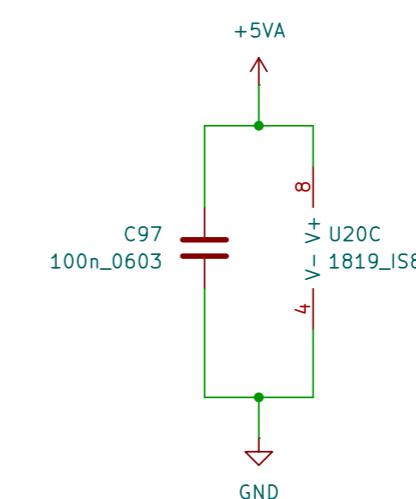
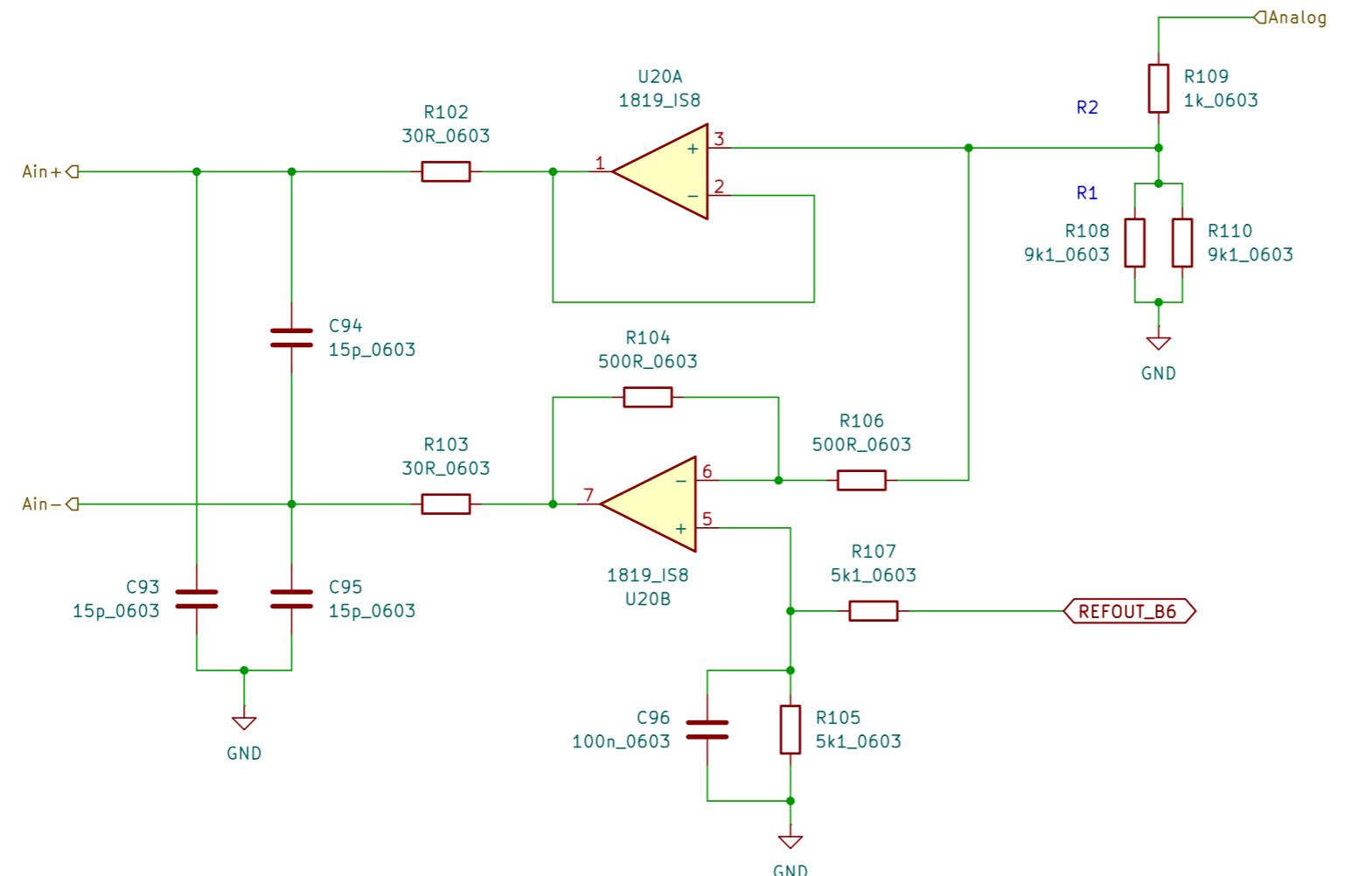
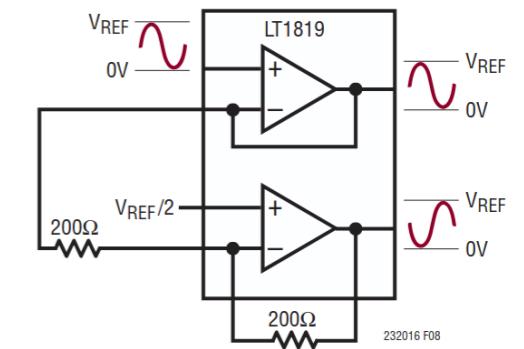








Single ended to differential for B6

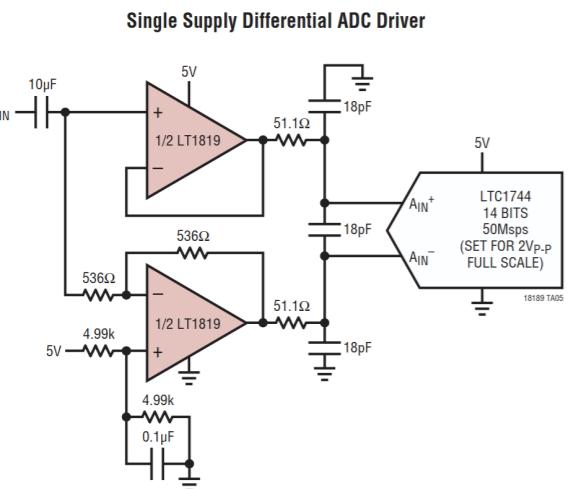


Sheet: /ADC for B6/Diffamp\_2/  
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**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 20/48

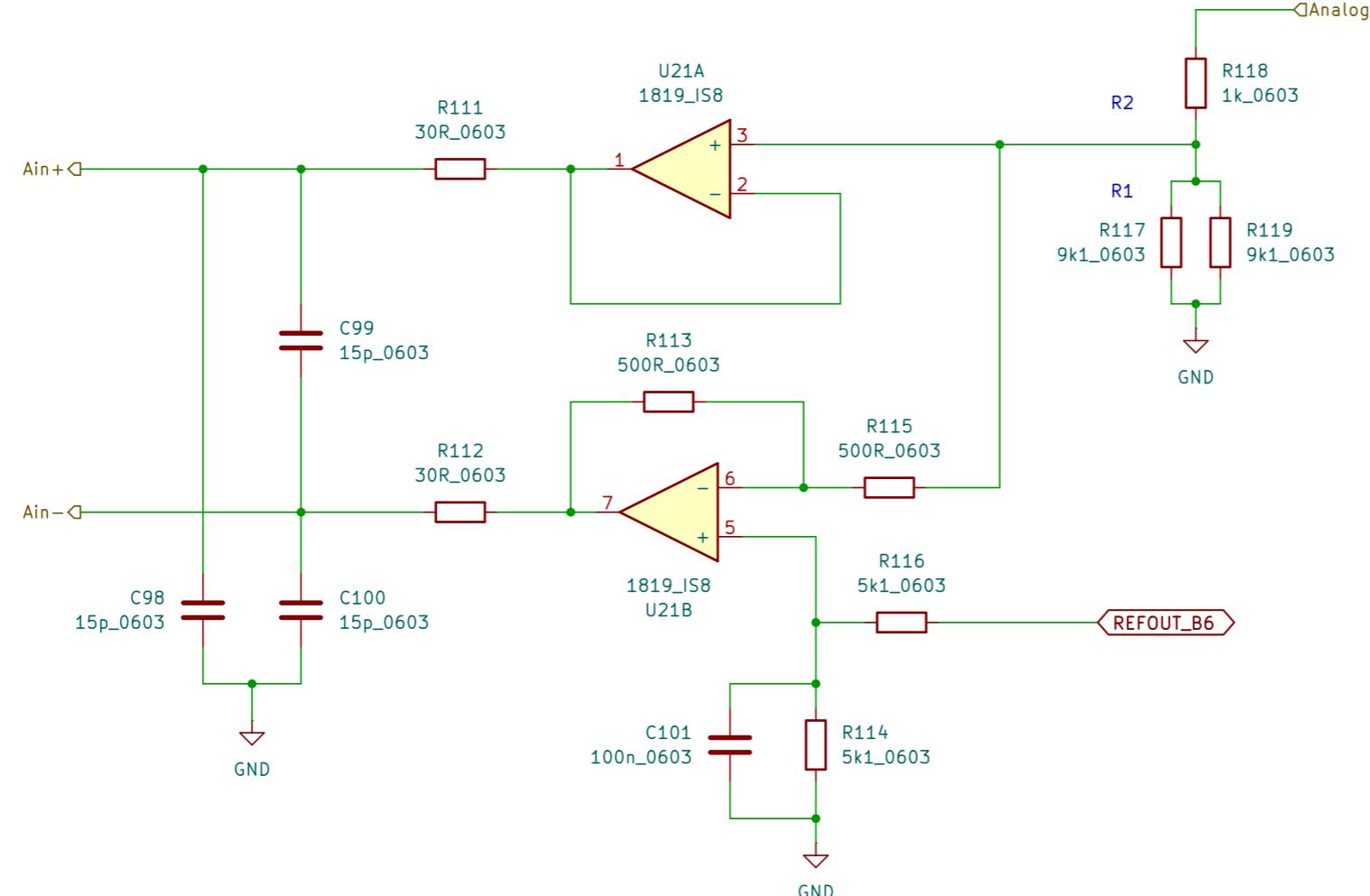
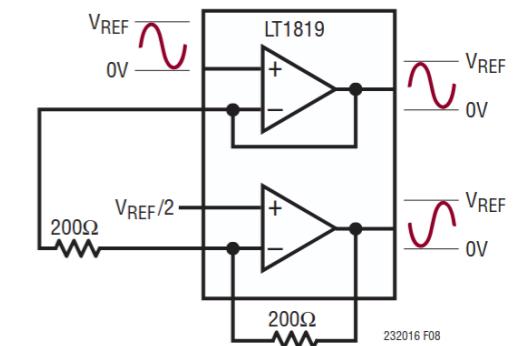


ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6

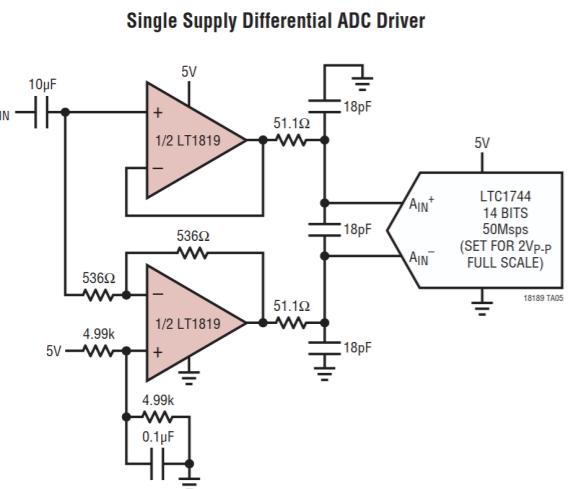


Sheet: /ADC for B6/Diffamp\_3/  
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**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

**Rev:**  
Id: 21/48

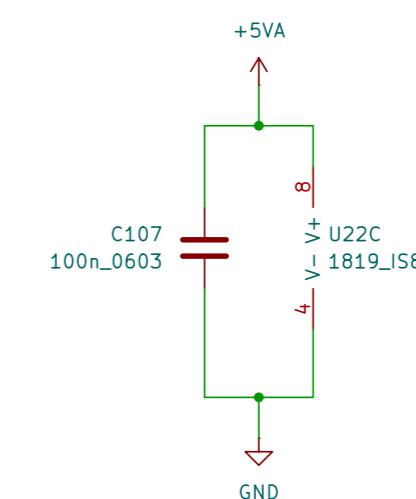
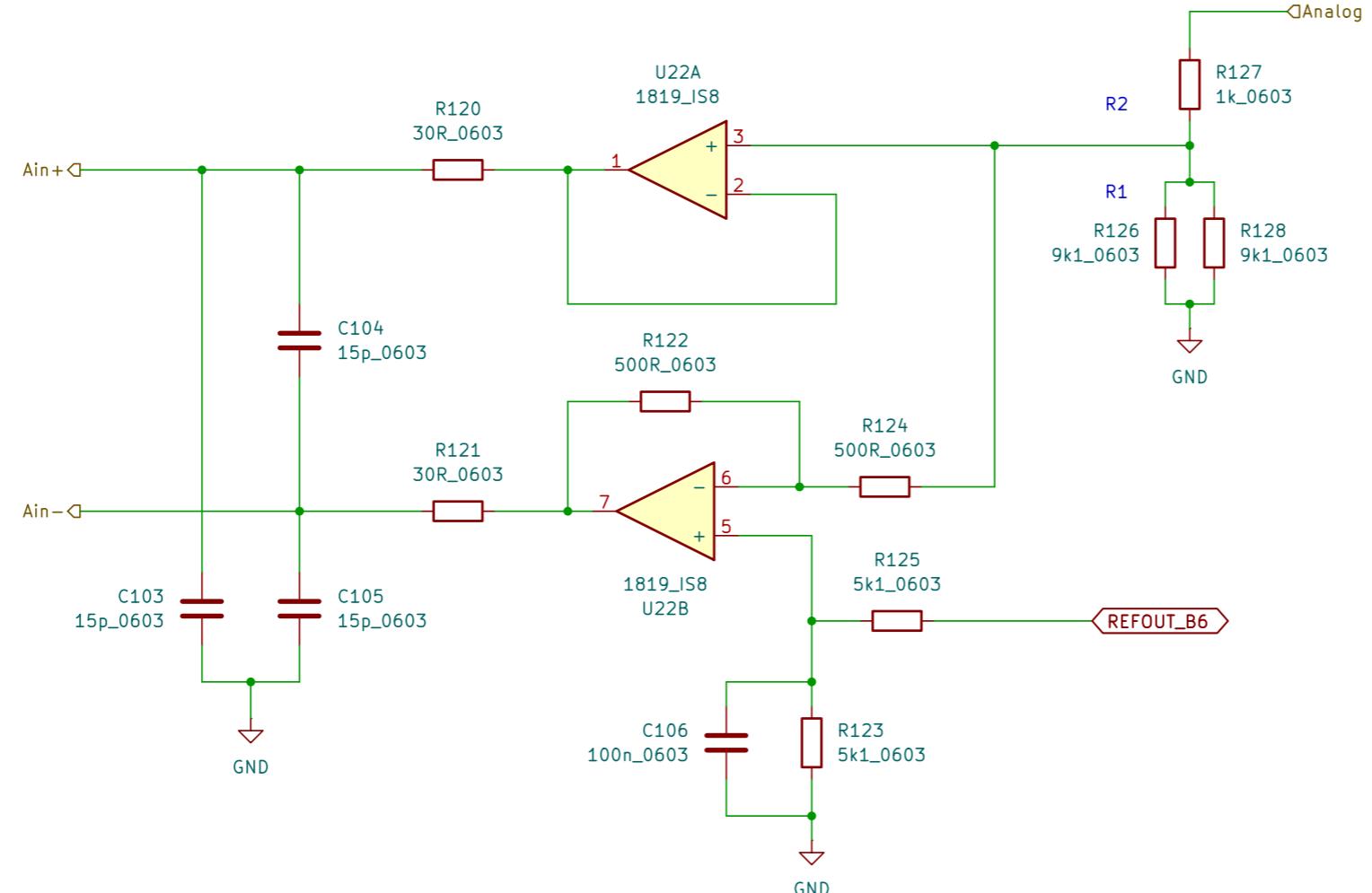
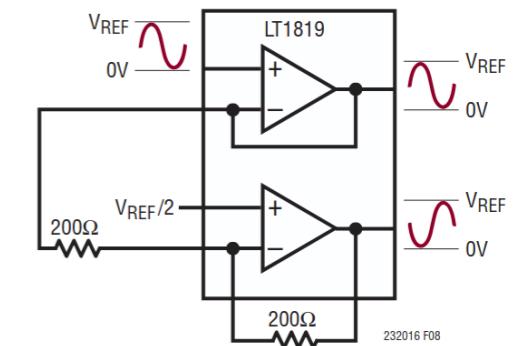


ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6

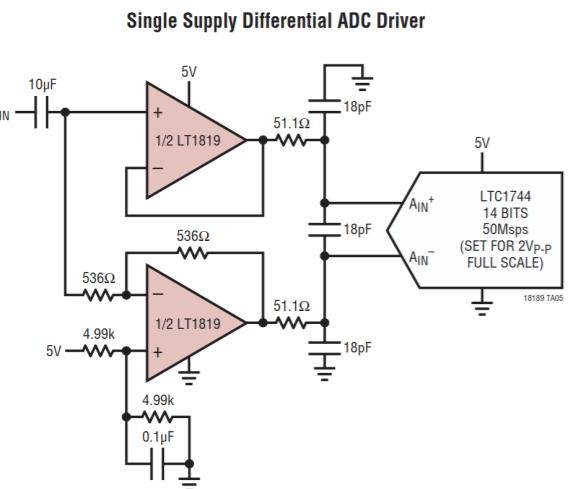


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File: diffamp\_.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 22/48



ADC Reference is 4.096V

$$V_{out} = V * R_1 / (R_1 + R_2)$$

$$4.096V = 5V * R_1 / (R_1 + R_2)$$

$$0.8192 = R_1 / (R_1 + R_2)$$

$$0.8192 * R_1 + 0.8192 * R_2 = R_1$$

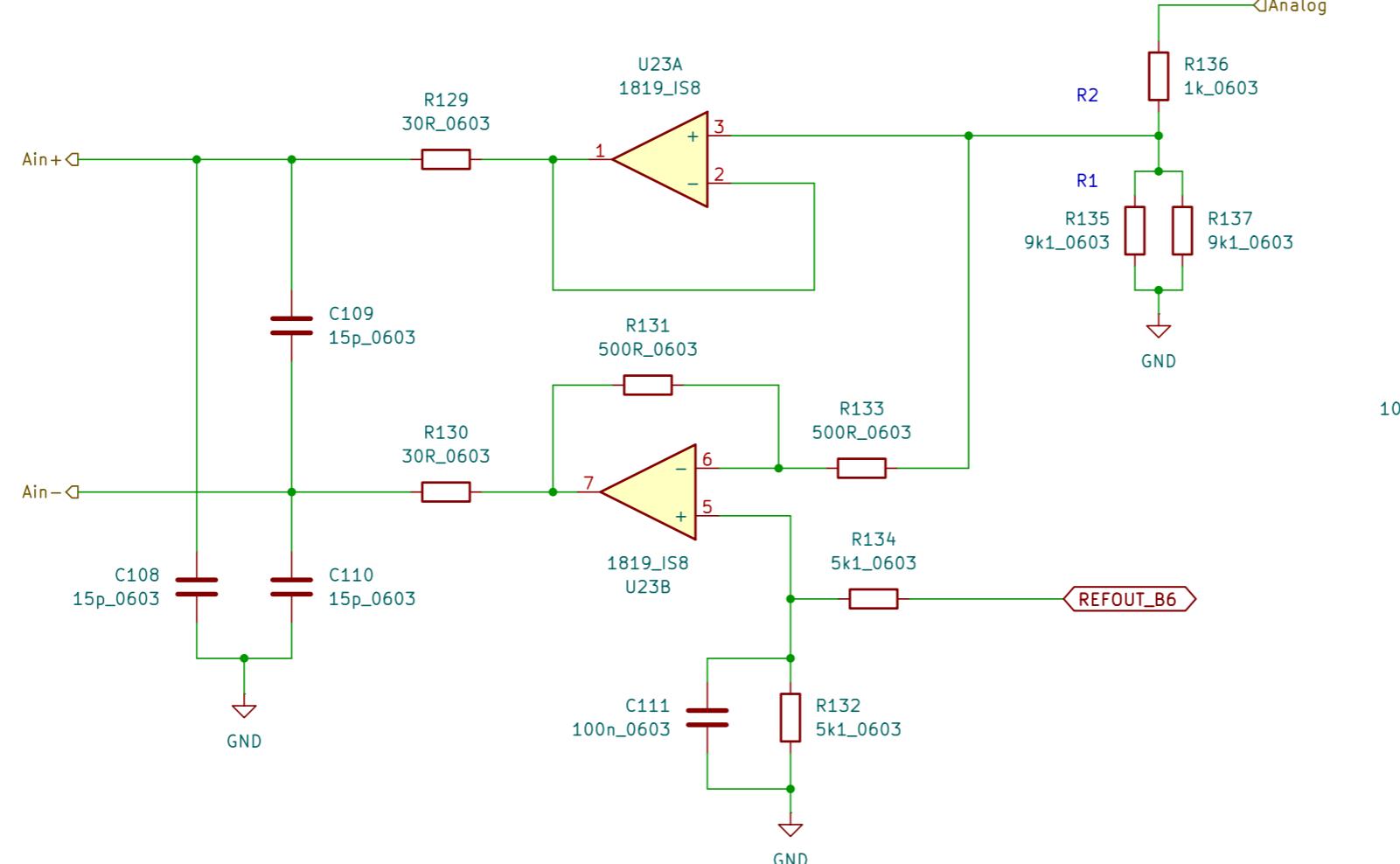
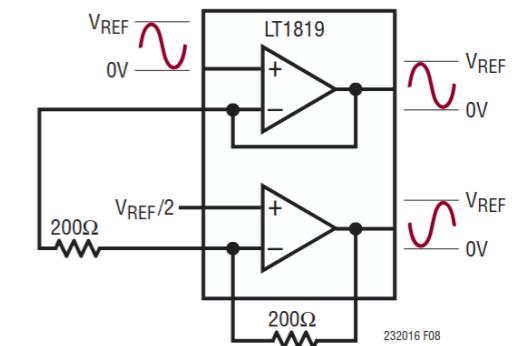
$$0.1808 * R_1 = 0.8192 * R_2$$

$$R_1 / R_2 = 4.53097$$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6

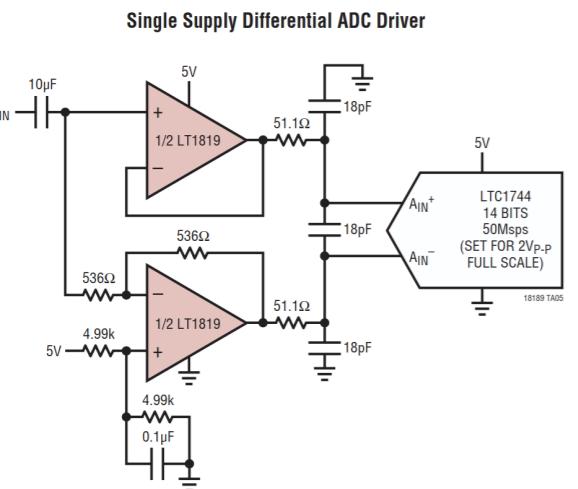


Sheet: /ADC for B6/Diffamp\_5/  
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**Title:**

Size: A4 Date:  
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Rev:  
Id: 23/48

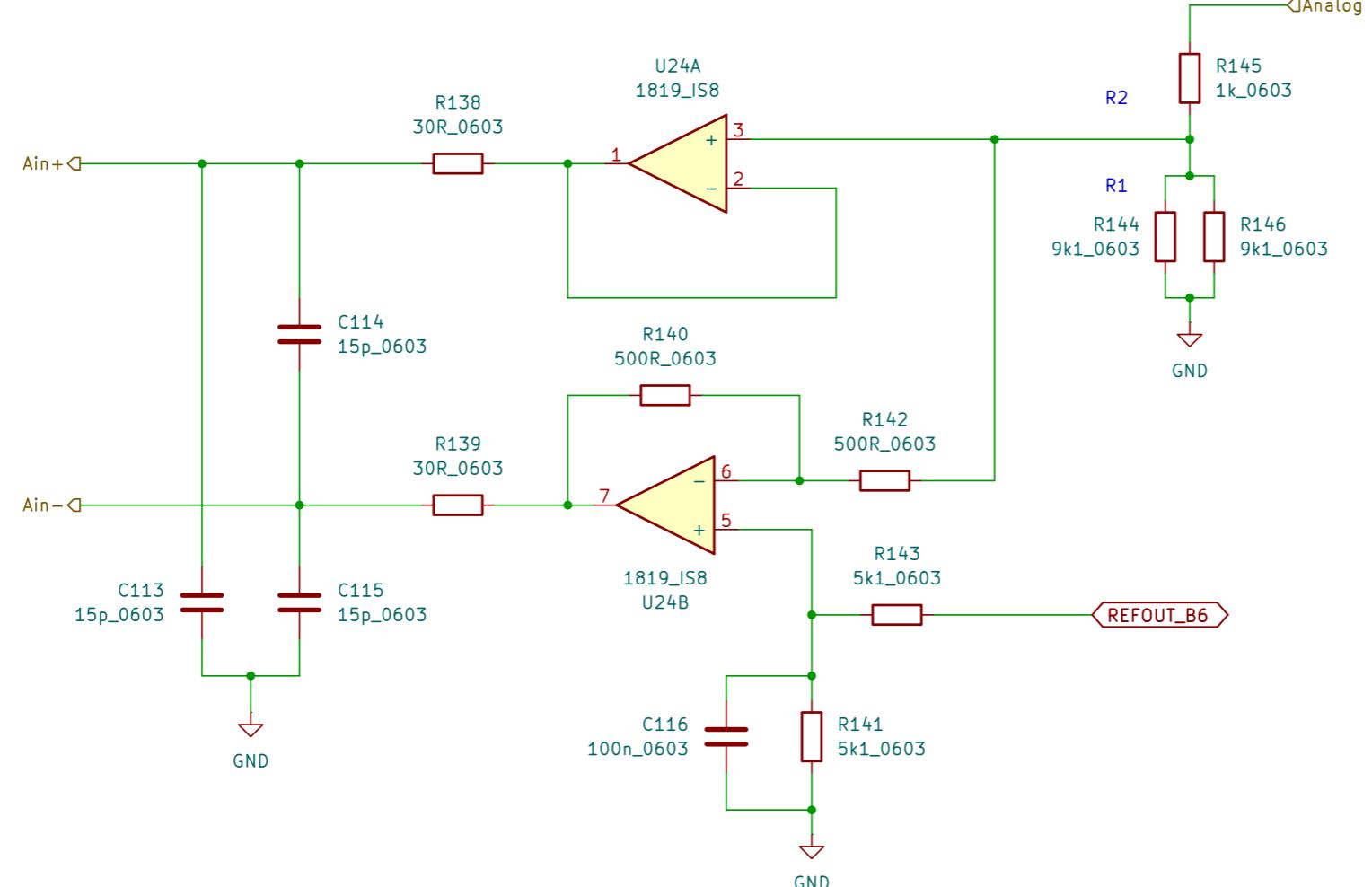
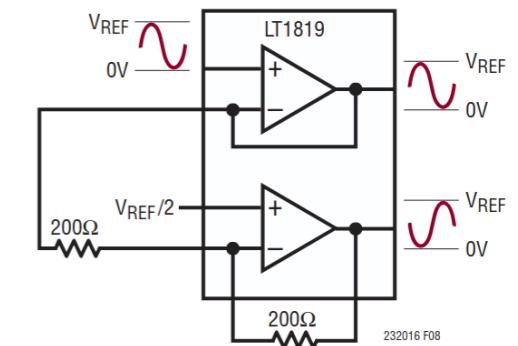


ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6

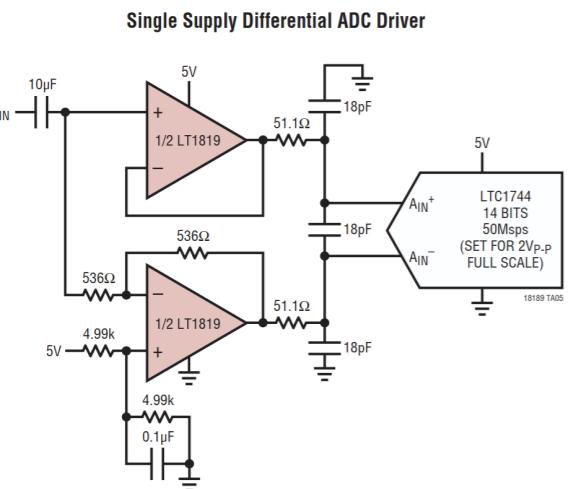


Sheet: /ADC for B6/Diffamp\_6/  
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**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 24/48

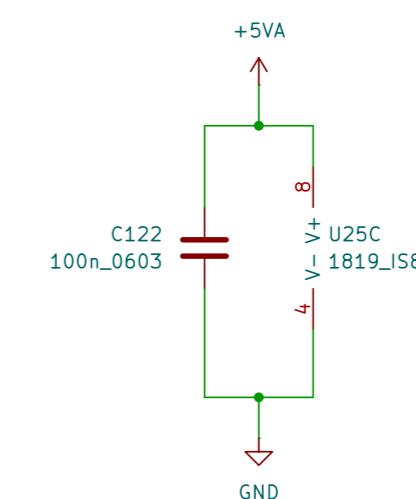
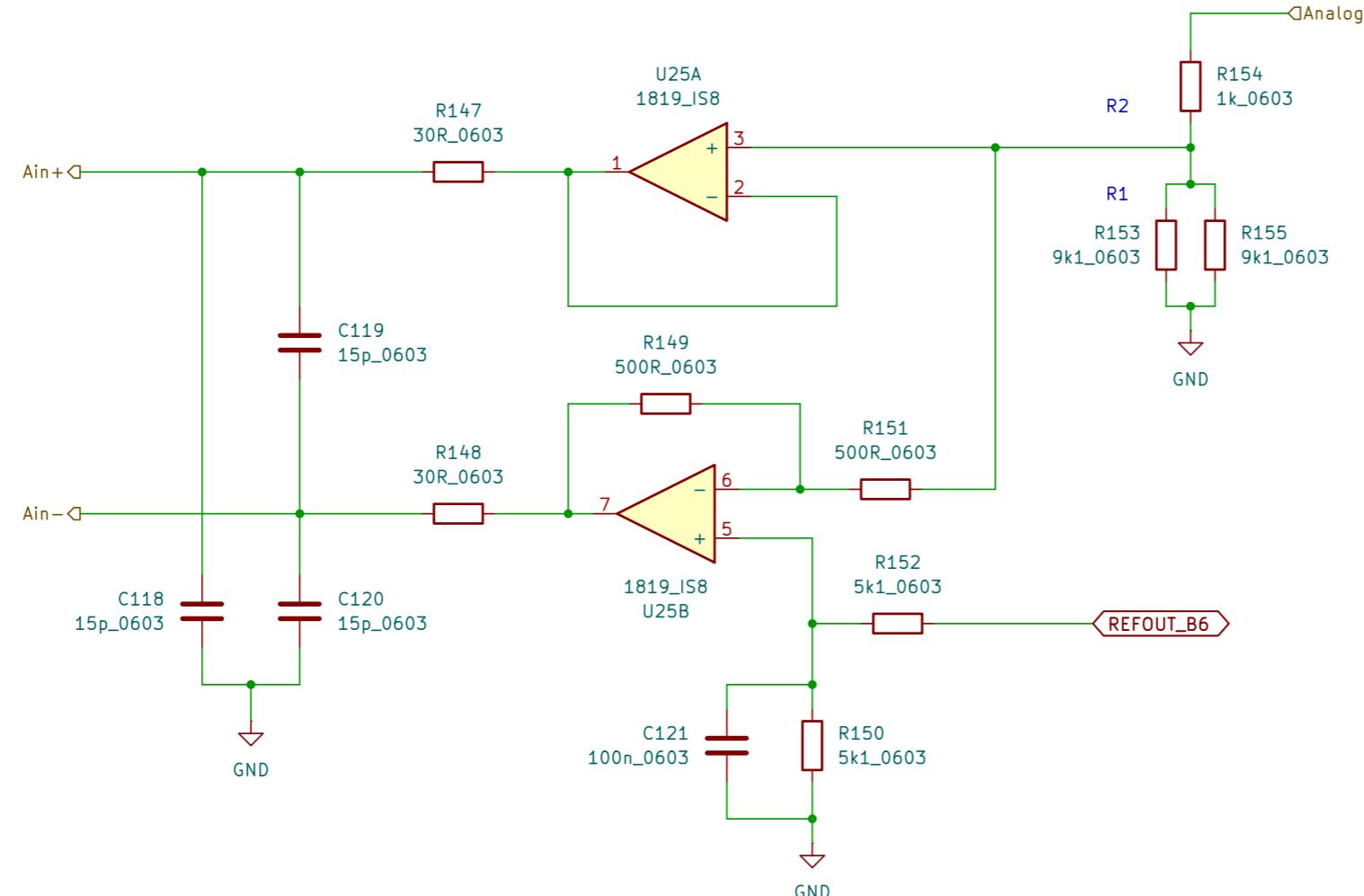
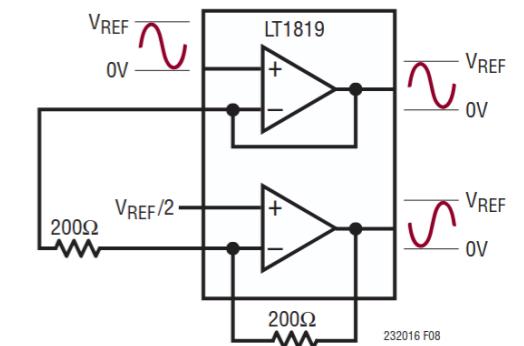


ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6

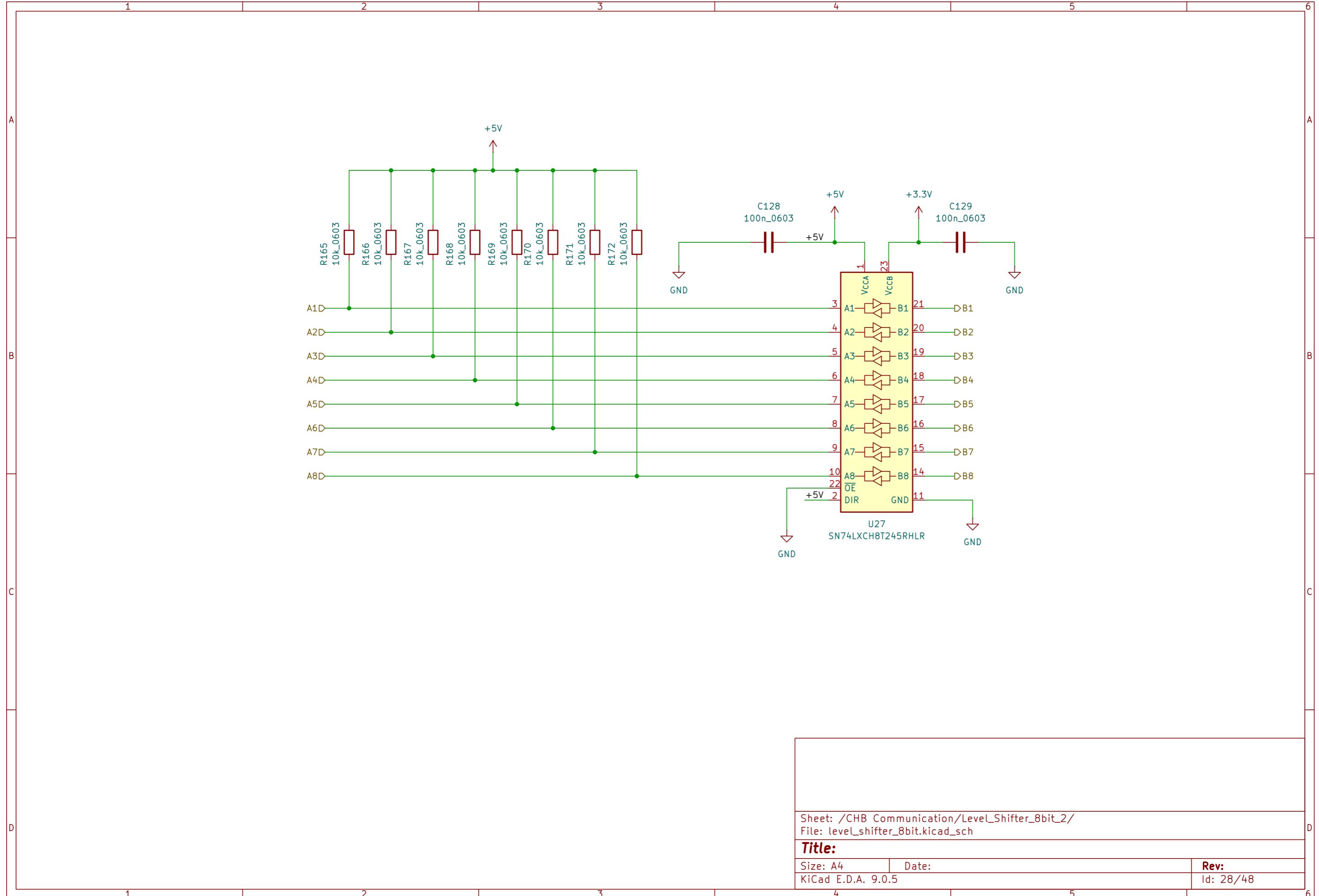


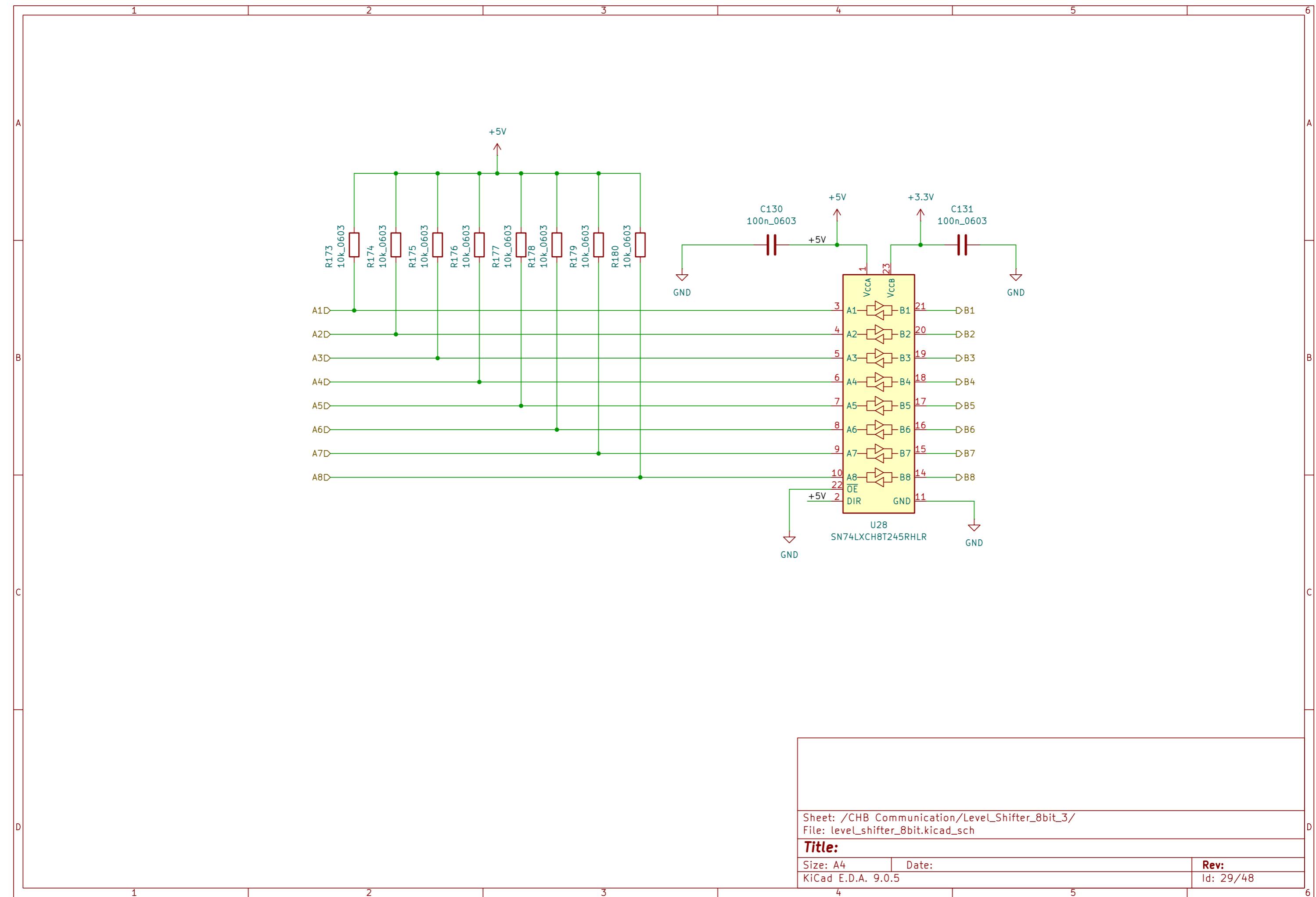
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File: diffamp\_.kicad\_sch

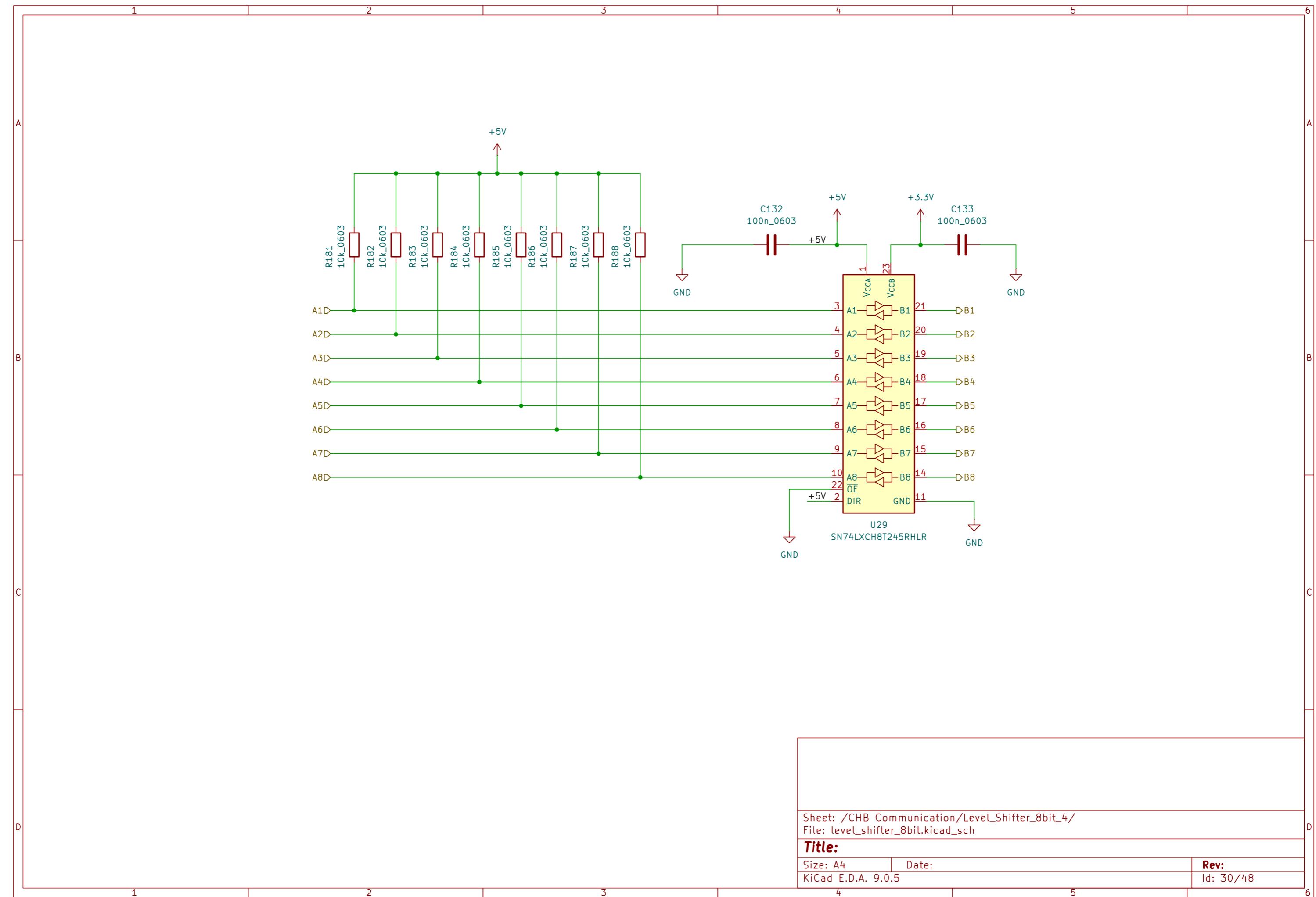
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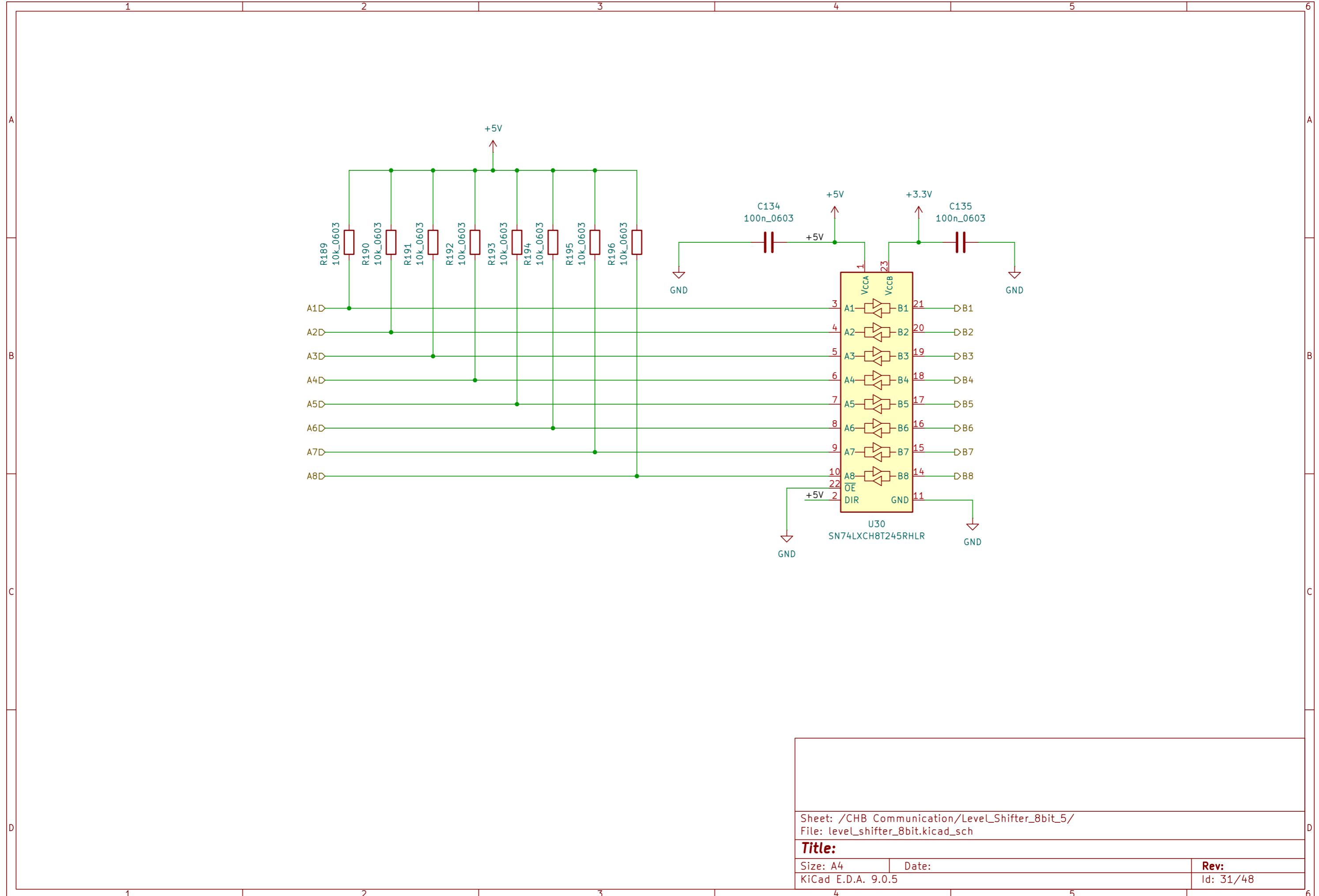
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KiCad E.D.A. 9.0.5

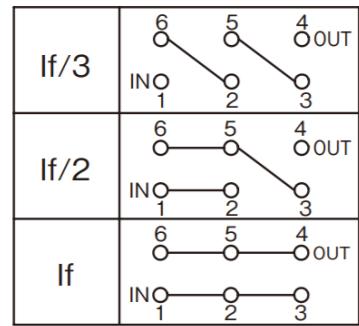
Rev:  
Id: 25/48





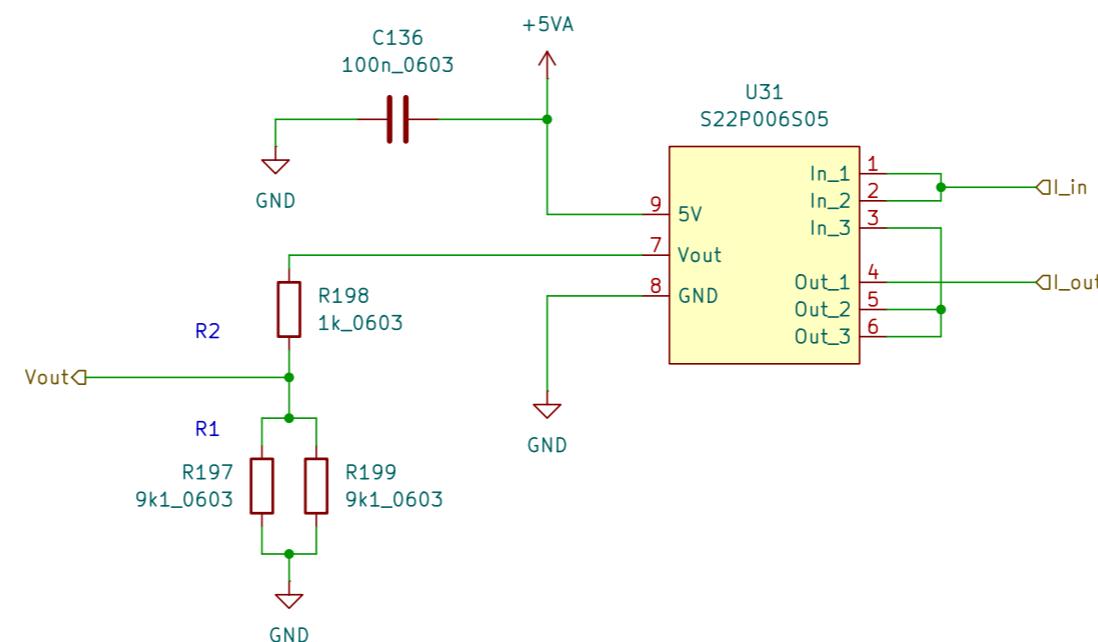






ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$   
 $R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$   
 $V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
-> very little saturation

If for S22P006S05 is 6A

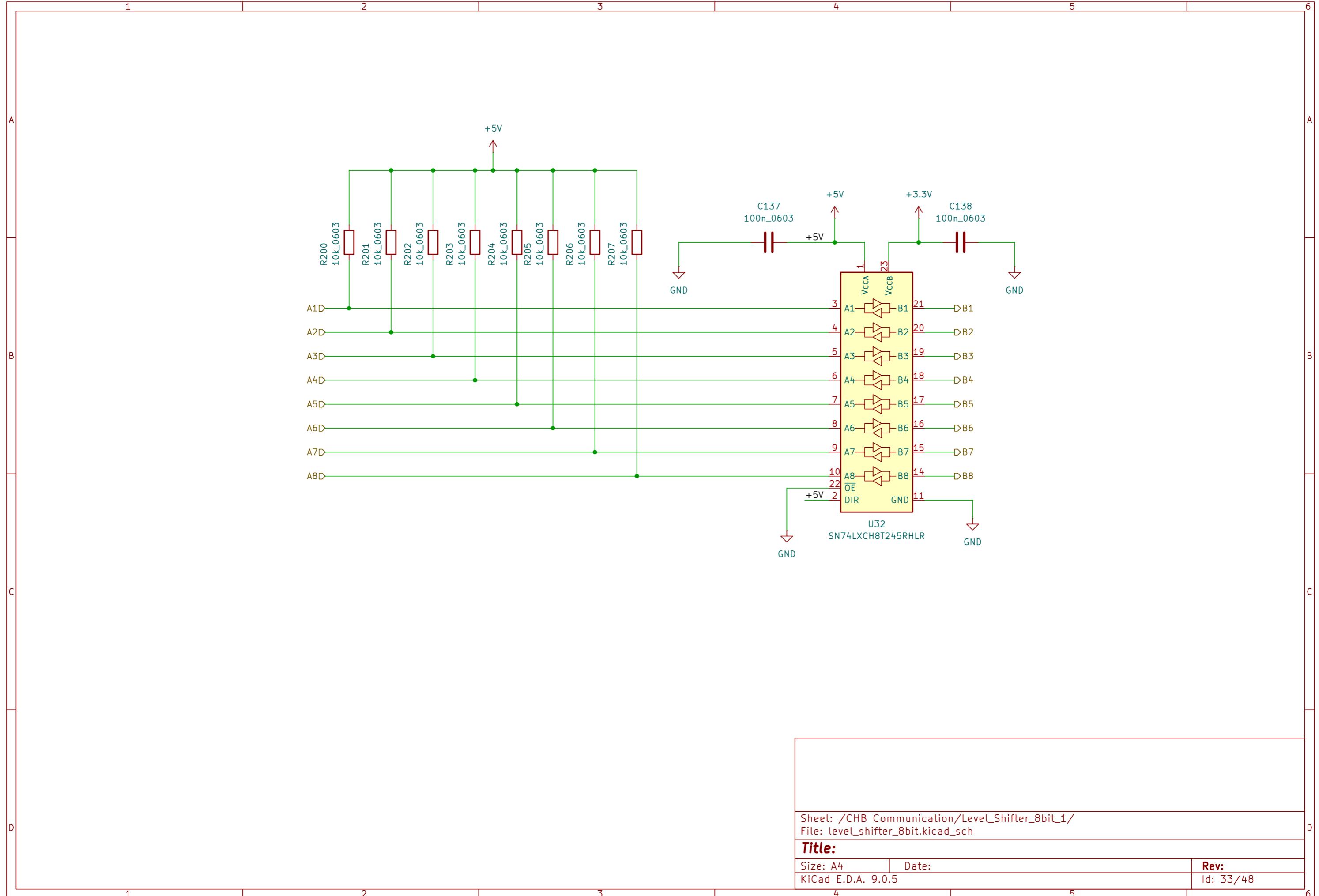


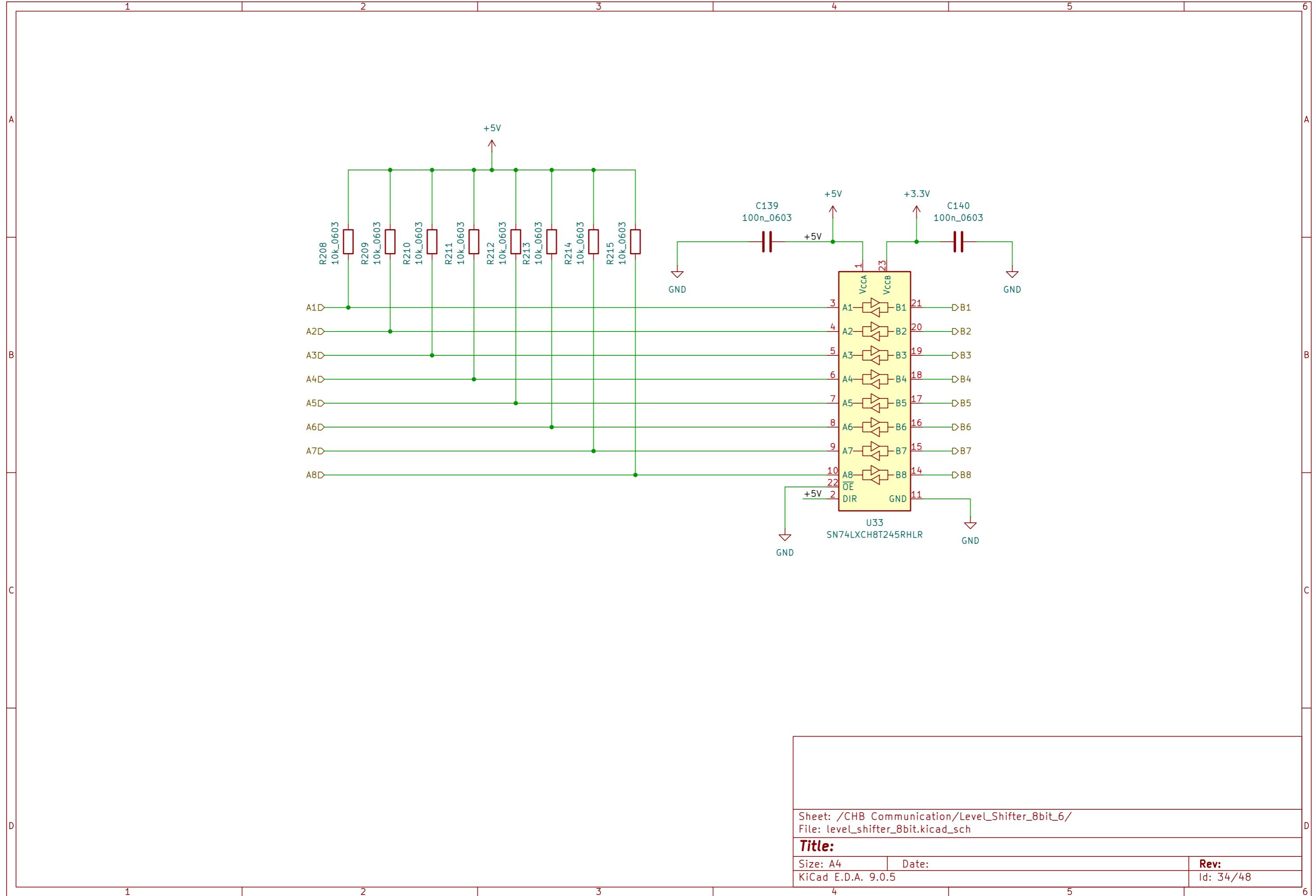
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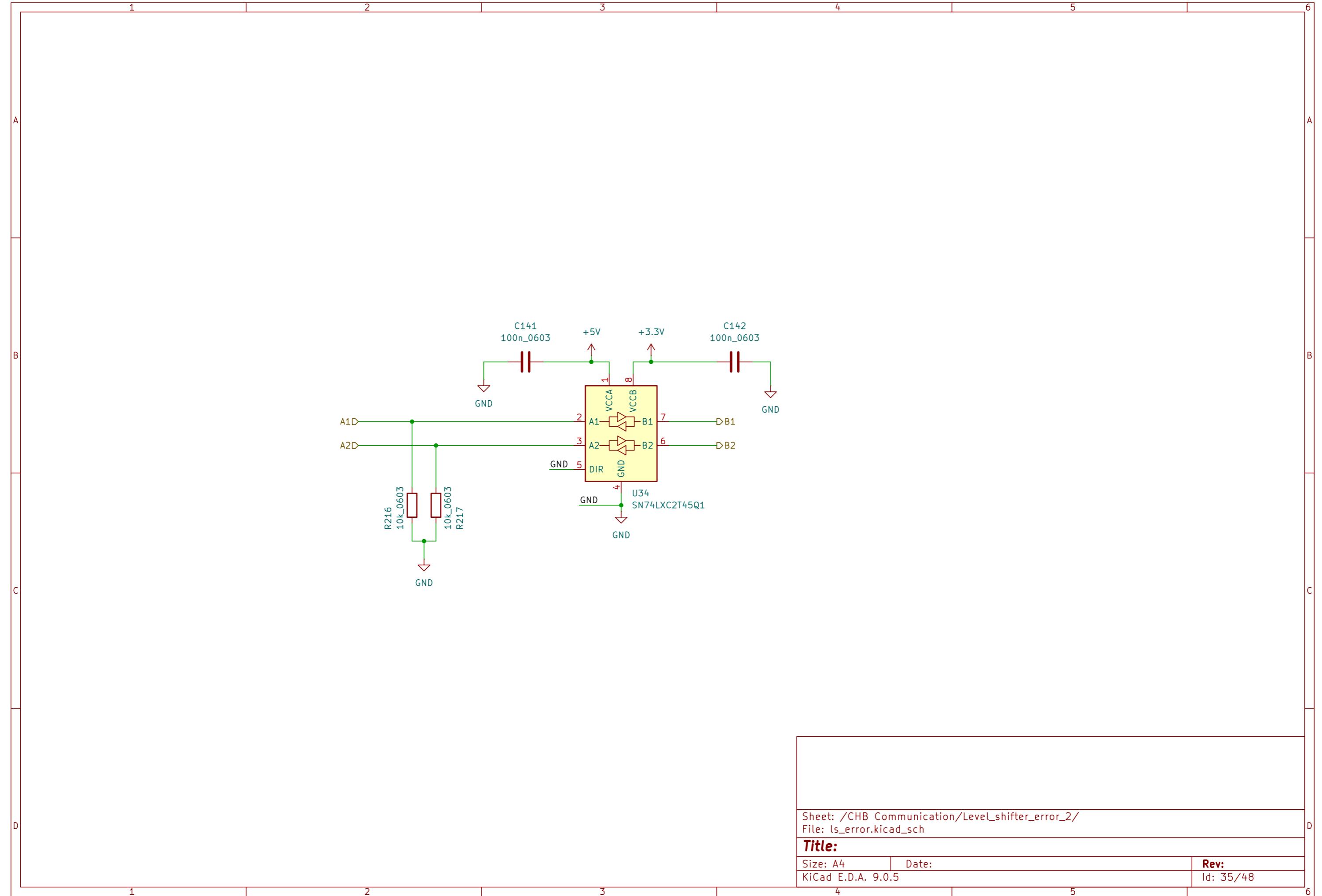
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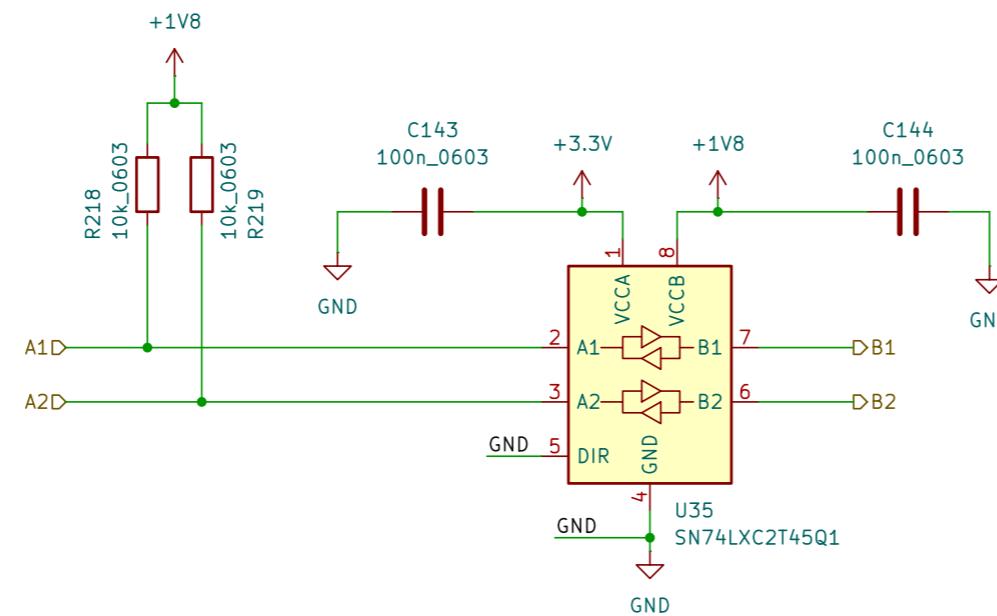
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Rev:  
Id: 32/48









Sheet: /ADC for B6/Level Shift for DIO/  
File: ls\_for\_dio.kicad\_sch

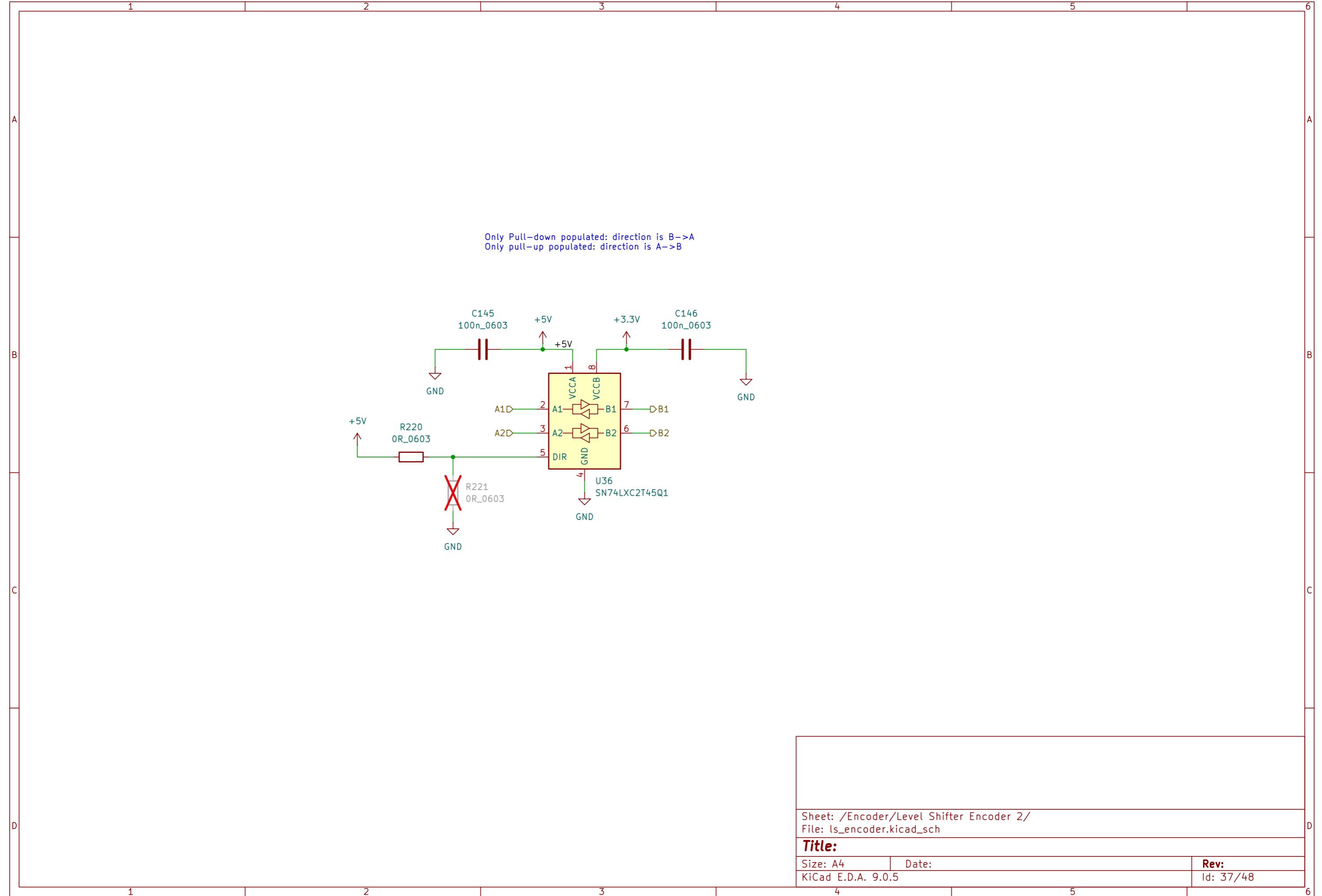
**Title:**

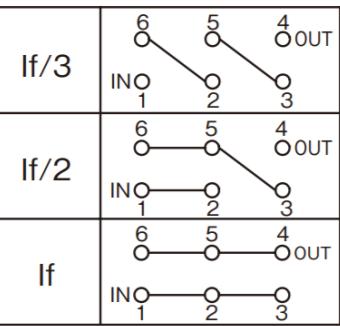
Size: A4 Date:

KiCad E.D.A. 9.0.5

**Rev:**

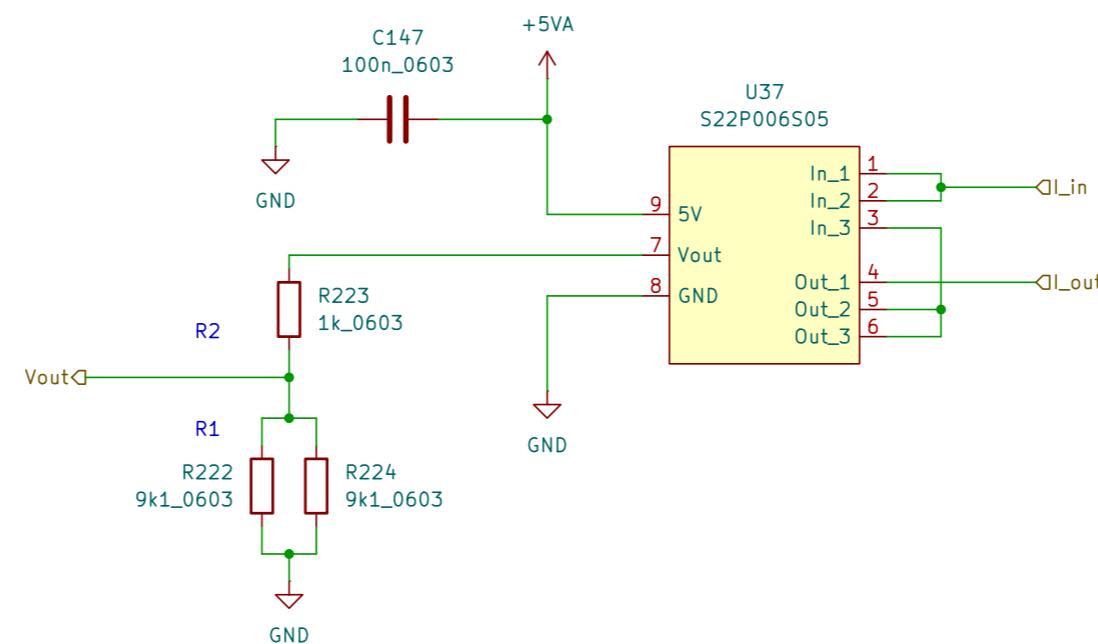
Id: 36/48





ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$   
 $R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$   
 $V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
-> very little saturation

If for S22P006S05 is 6A

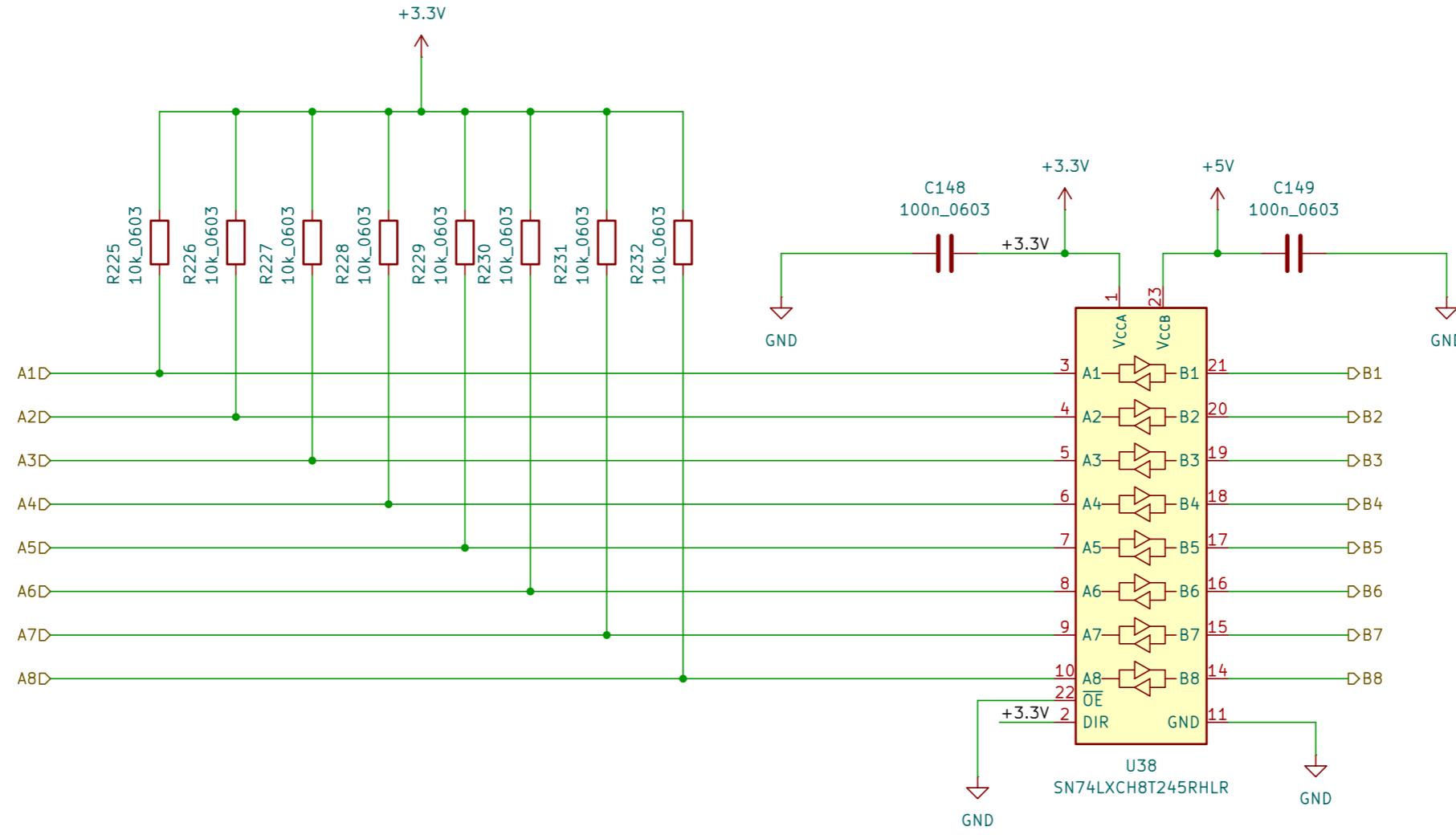


Sheet: /Current measure/Tamura\_3/  
File: tamura.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 38/48

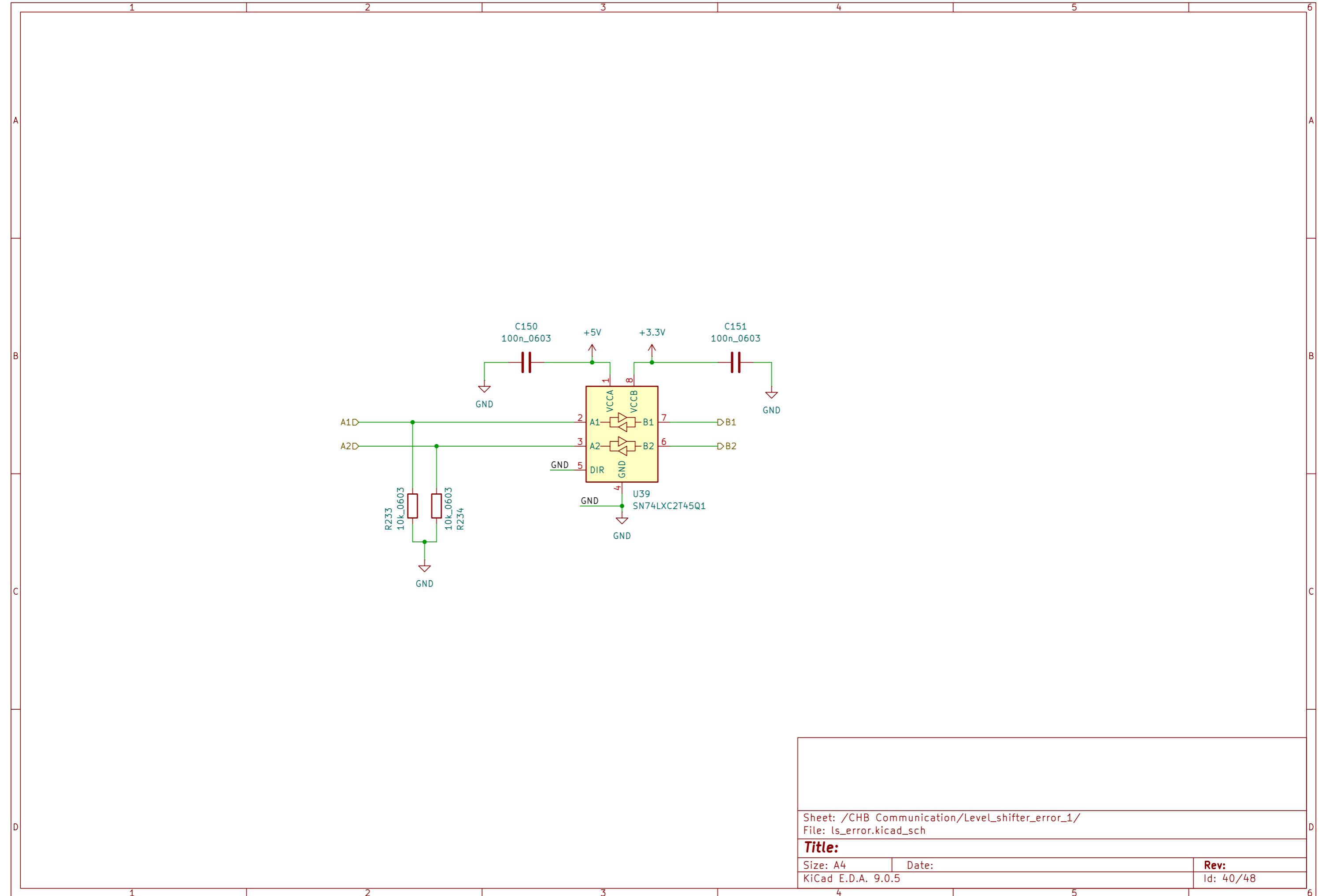


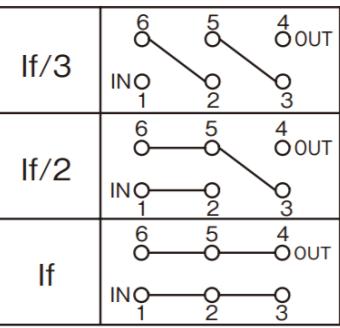
Sheet: /CHB Communication/Level\_shifter\_Rx\_En/  
File: ls\_rx\_en.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

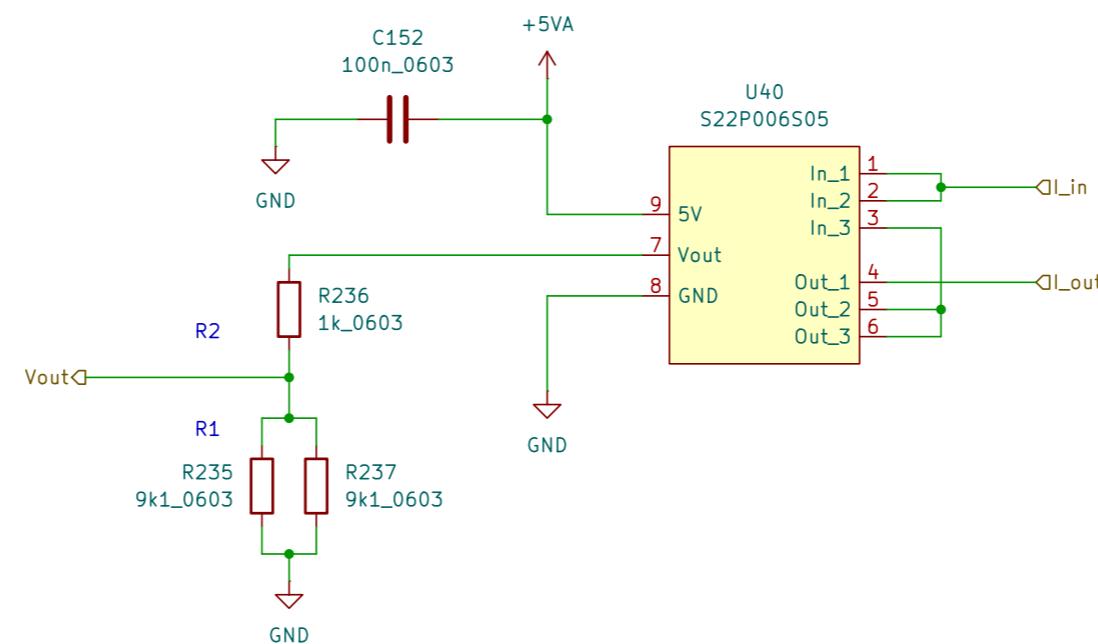
Rev:  
Id: 39/48





ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$   
 $R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$   
 $V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
-> very little saturation

If for S22P006S05 is 6A

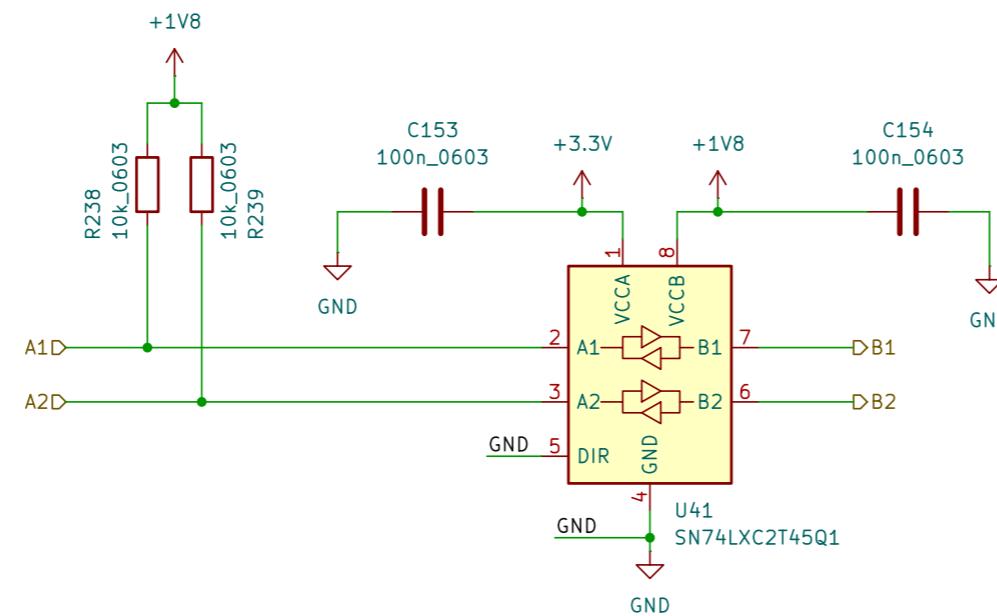


Sheet: /Current measure/Tamura\_4/  
File: tamura.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 41/48

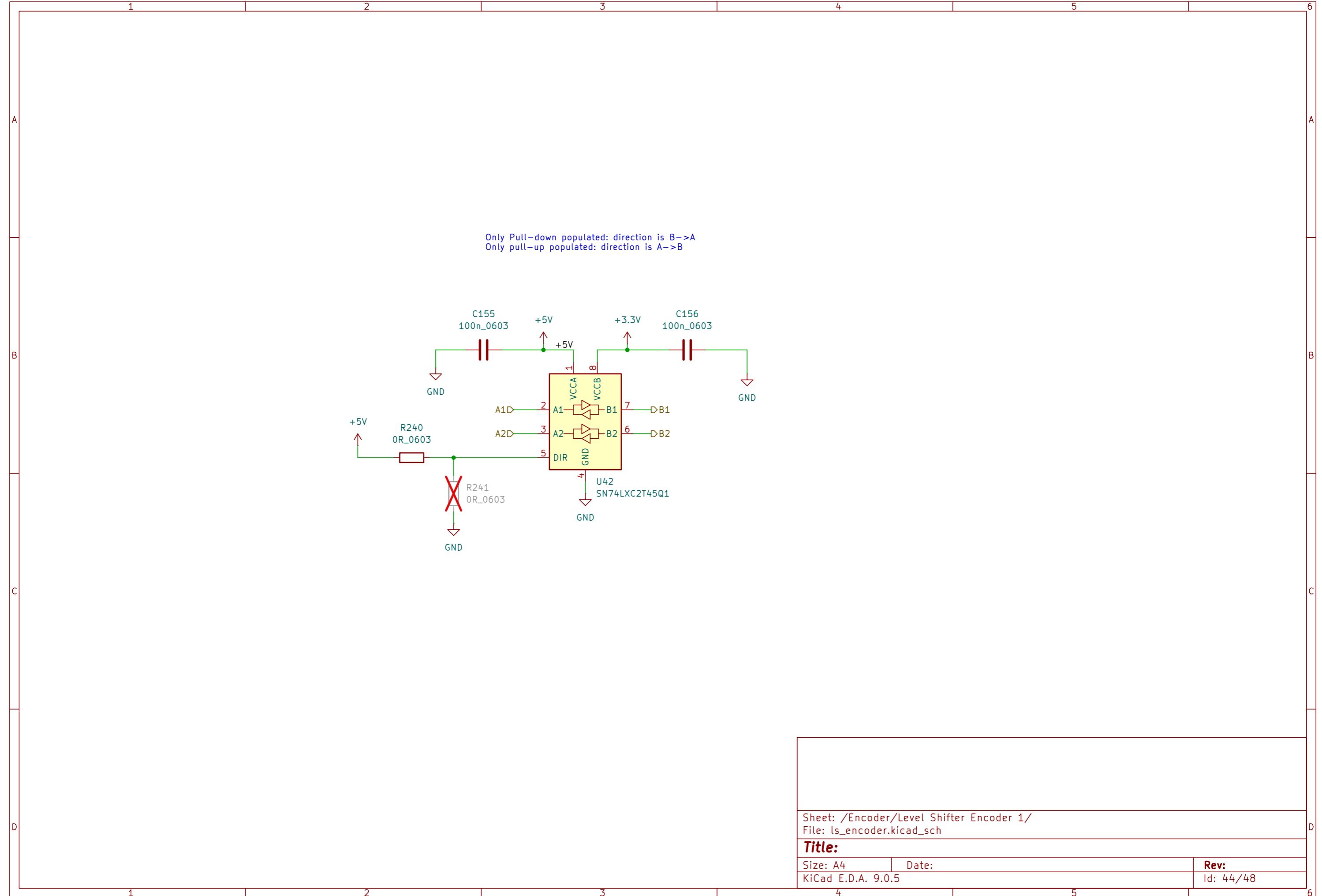


Sheet: /ADC for Machine/Level Shift for DIO/  
File: ls\_for\_dio.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 42/48

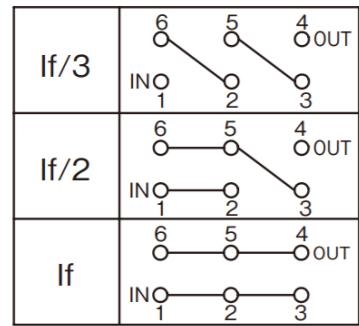


Sheet: /Encoder/Level Shifter Encoder 1/  
File: ls\_encoder.kicad\_sch

**Title:**

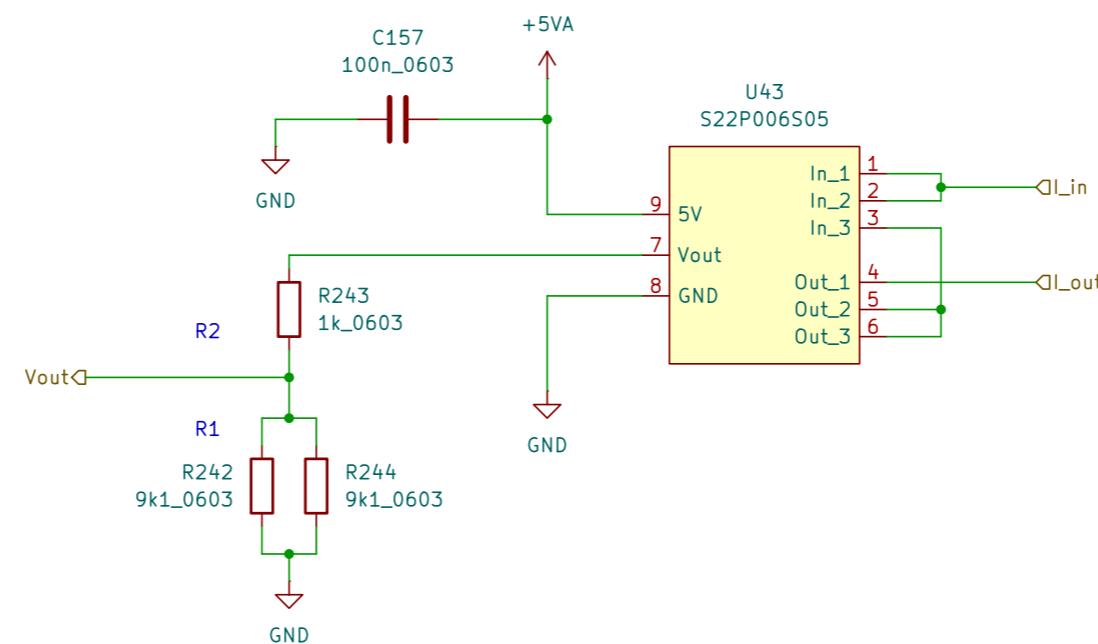
Size: A4      Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 44/48



ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$   
 $R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$   
 $V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
-> very little saturation

If for S22P006S05 is 6A

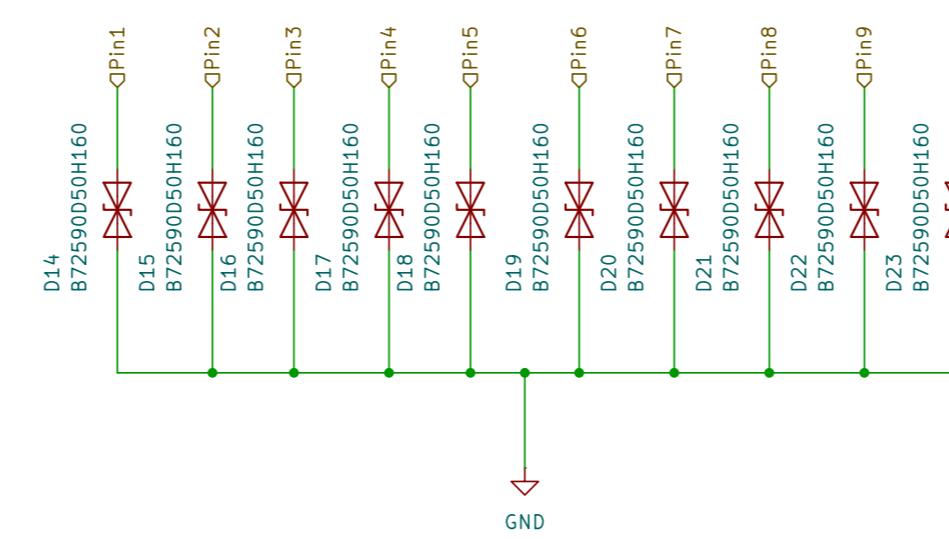


Sheet: /Current measure/Tamura\_1/  
File: tamura.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 45/48

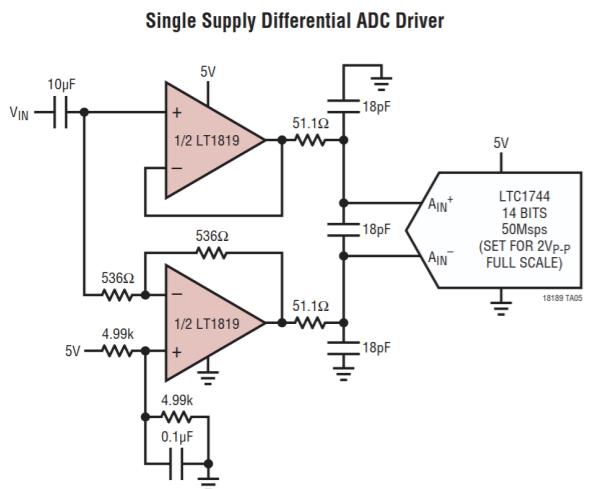


Sheet: /FPGA/esd\_diodes/  
File: esd\_diodes.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

Rev:  
Id: 49/48

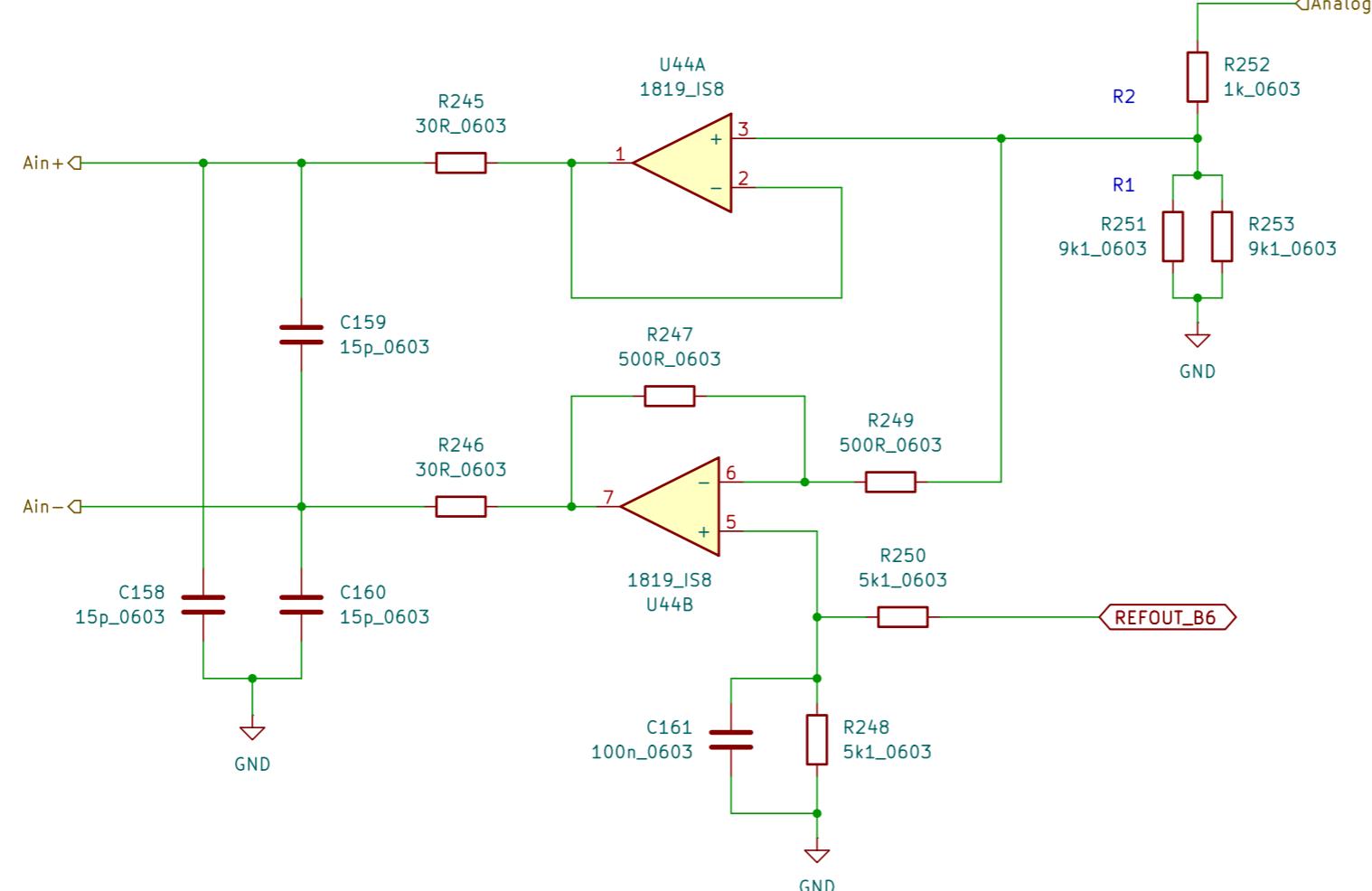
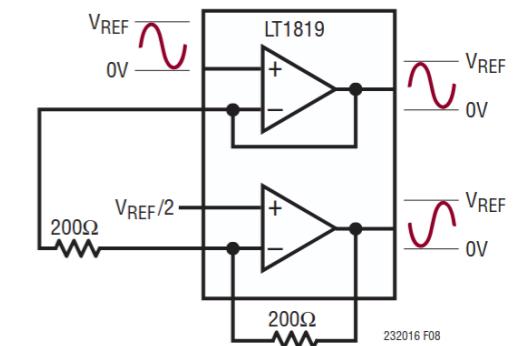


ADC Reference is 4.096V  
 $V_{out} = V * R_1 / (R_1 + R_2)$   
 $4.096V = 5V * R_1 / (R_1 + R_2)$   
 $0.8192 = R_1 / (R_1 + R_2)$   
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$   
 $0.1808 * R_1 = 0.8192 * R_2$   
 $R_1 / R_2 = 4.53097$

$R_1 := 9.1k \parallel 9.1k = 4.55k$   
 $R_2 = 1k$   
 $R_1/R_2 = 4.55$

$V_{out\_max} = 5V * 4.55 / 5.55 = 4.099V$   
 $\rightarrow$  very little saturation

Single ended to differential for B6



Sheet: /ADC for B6/Diffamp\_1/  
File: diffamp\_.kicad\_sch

**Title:**

Size: A4 Date:  
KiCad E.D.A. 9.0.5

**Rev:**  
Id: 50/48