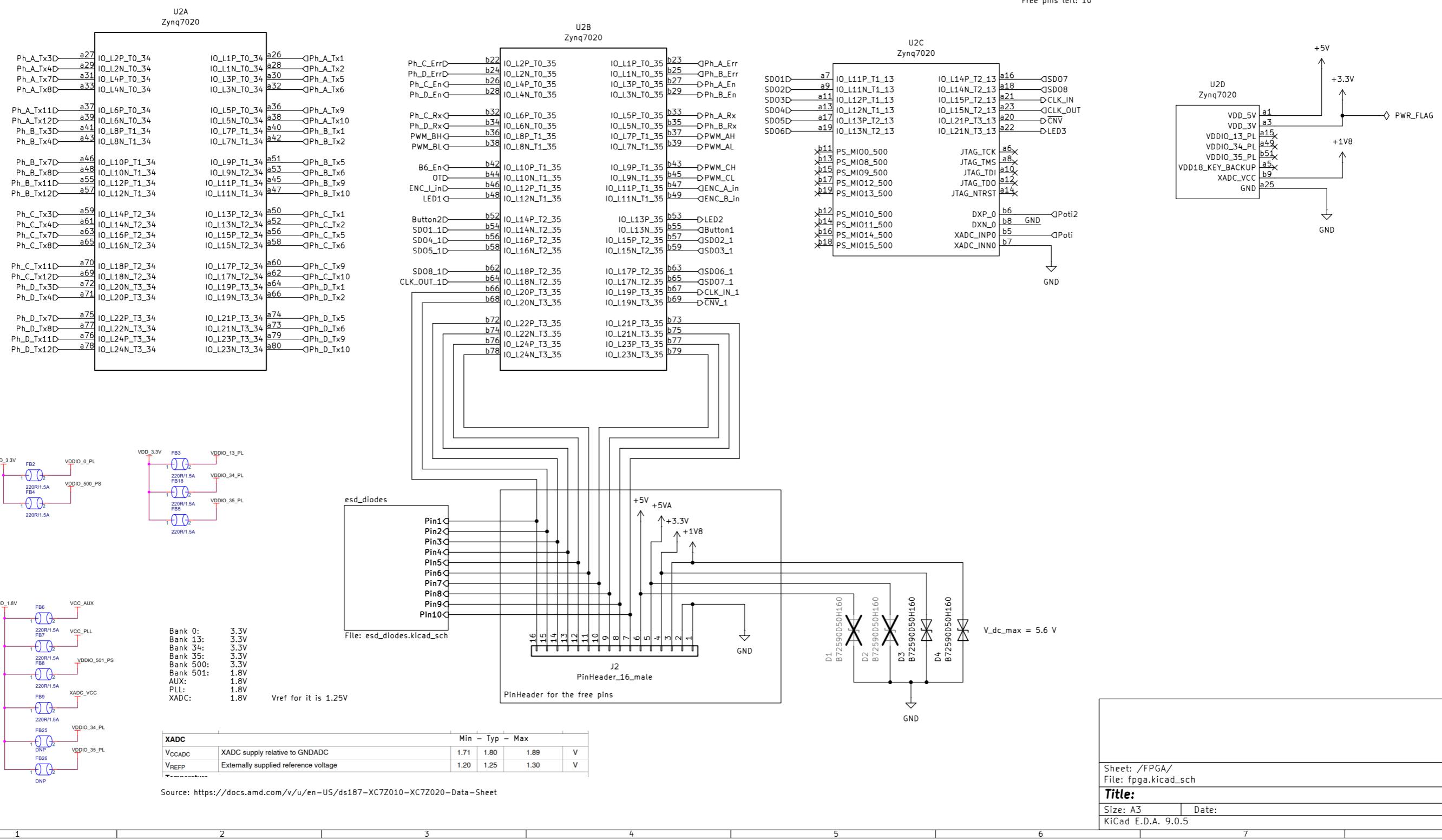


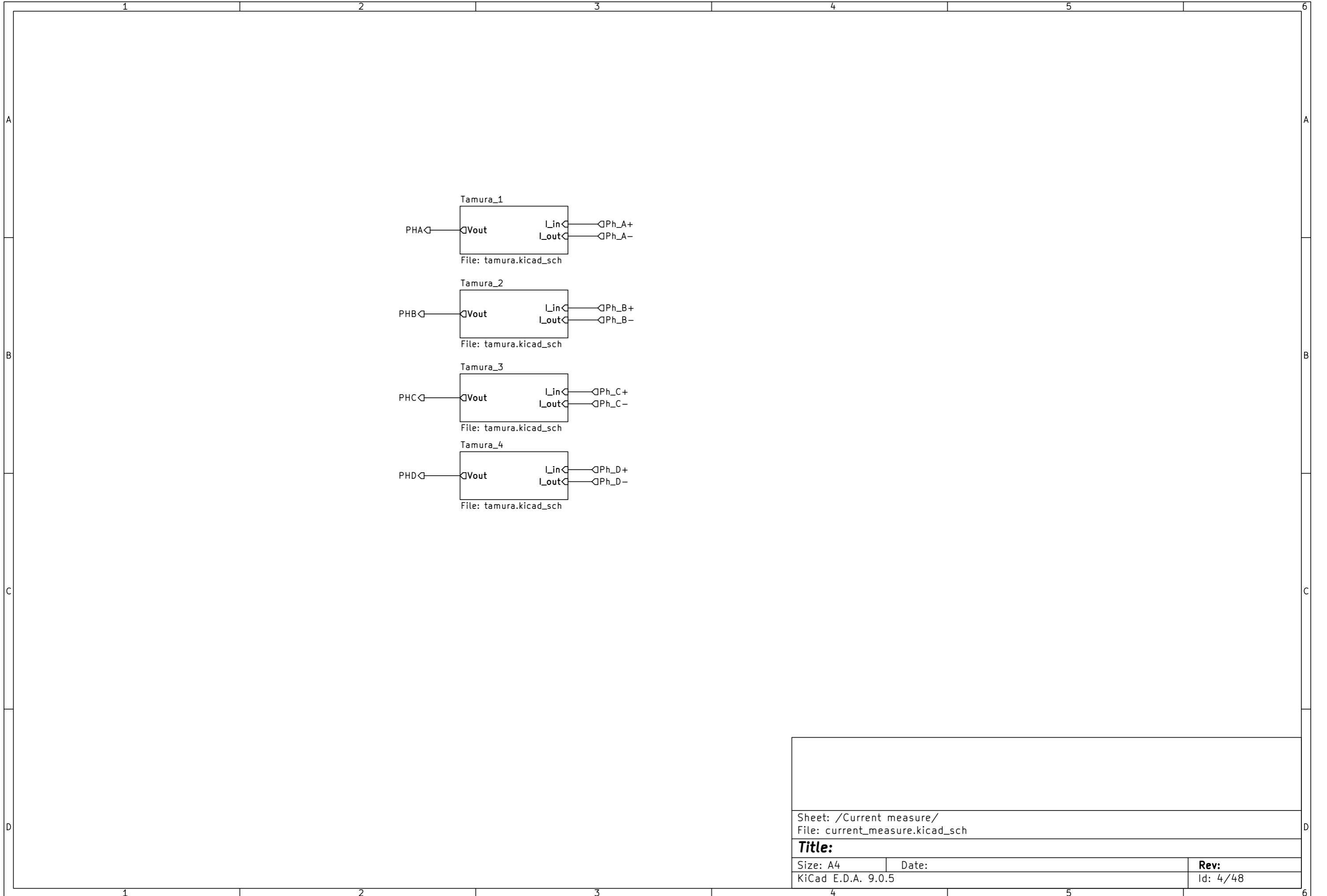
Table 1: Absolute Maximum Ratings⁽¹⁾ (Cont'd)

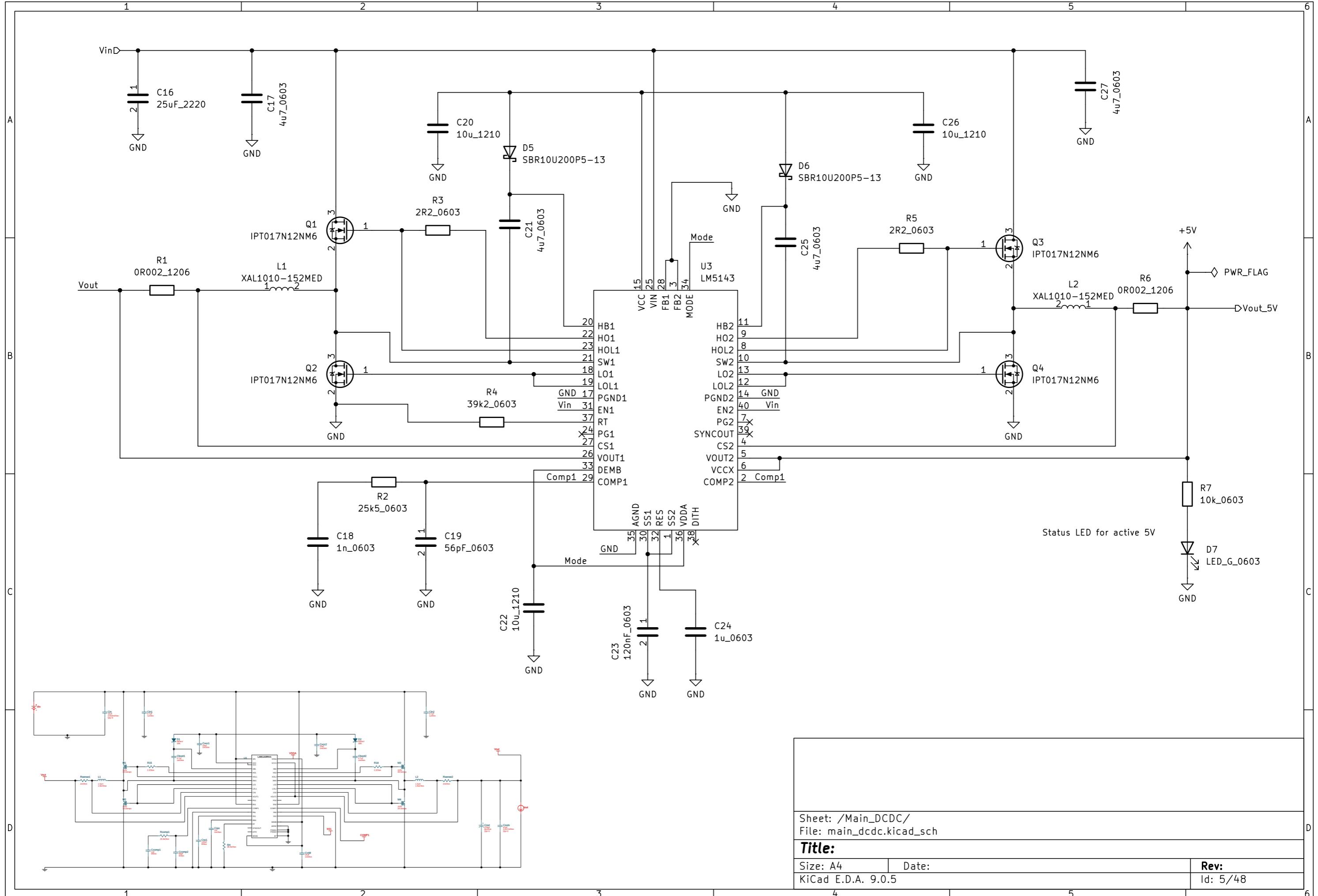
Symbol	Description	Min	Max	Units
$V_{IN}^{(3)(4)(5)}$	I/O input voltage for HR I/O banks	-0.40	$V_{CCO} + 0.55$	V
	I/O input voltage (when $V_{CCO} = 3.3V$) for V_{REF} and differential I/O standards except TMDS_33 ⁽⁶⁾	-0.40	2.625	V
V_{CCBATT}	Key memory battery backup supply	-0.5	2.0	V

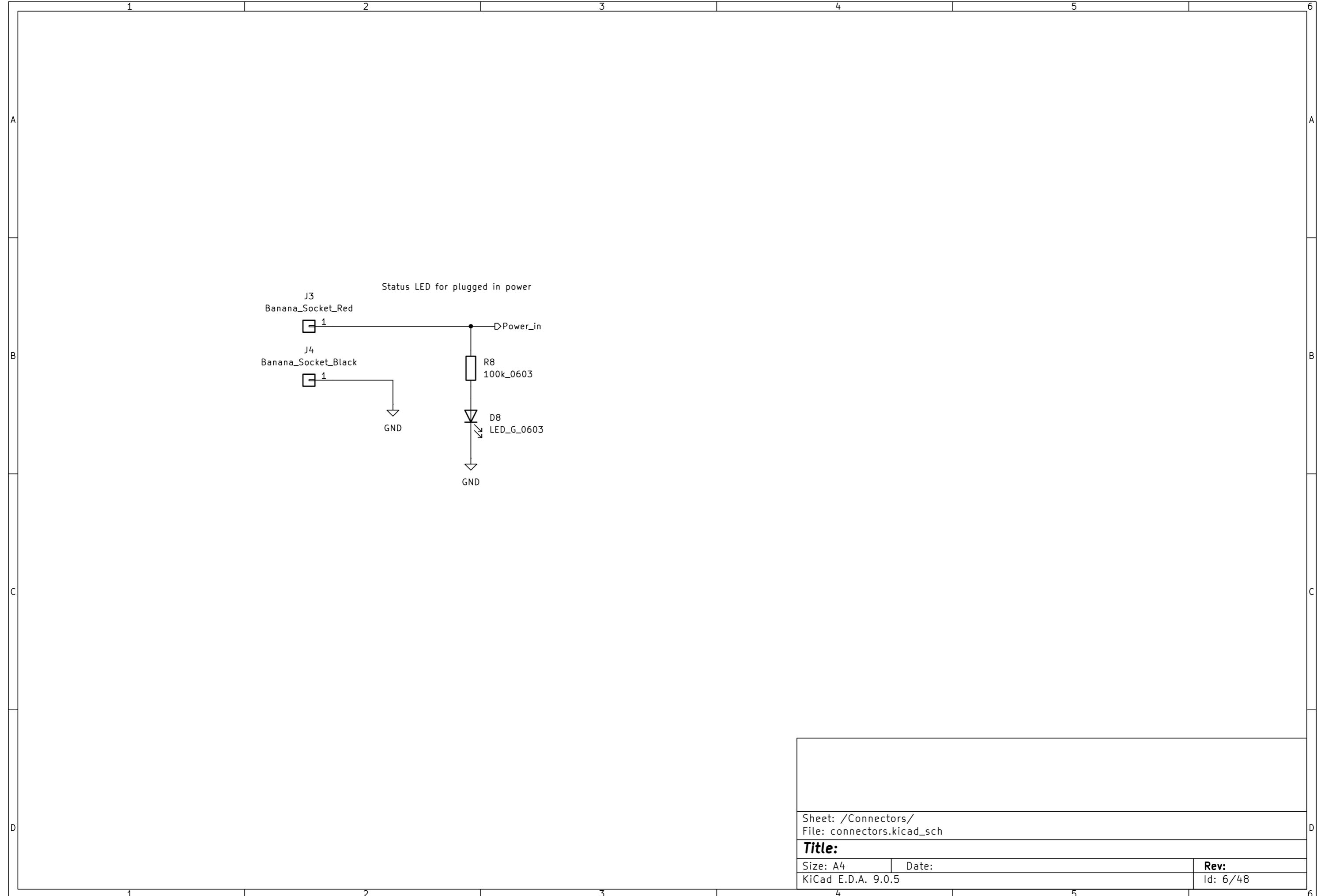
Bank 13: Total 12 pins -> ADC (11pins)
 Bank 34: Total 48 pins -> Tx Phase A,B,C,D (48 pins)
 Bank 35: Total 48 pins -> B6 (8pins) + CHB En/Err/Rx (12pins)
 + User Interactions (5 pins) + ADC_Machine (11pin) + encoder (3pins)
 XADC: 2 Pots

Free pins left: 10









1 2 3 4 5 6

A

A

B

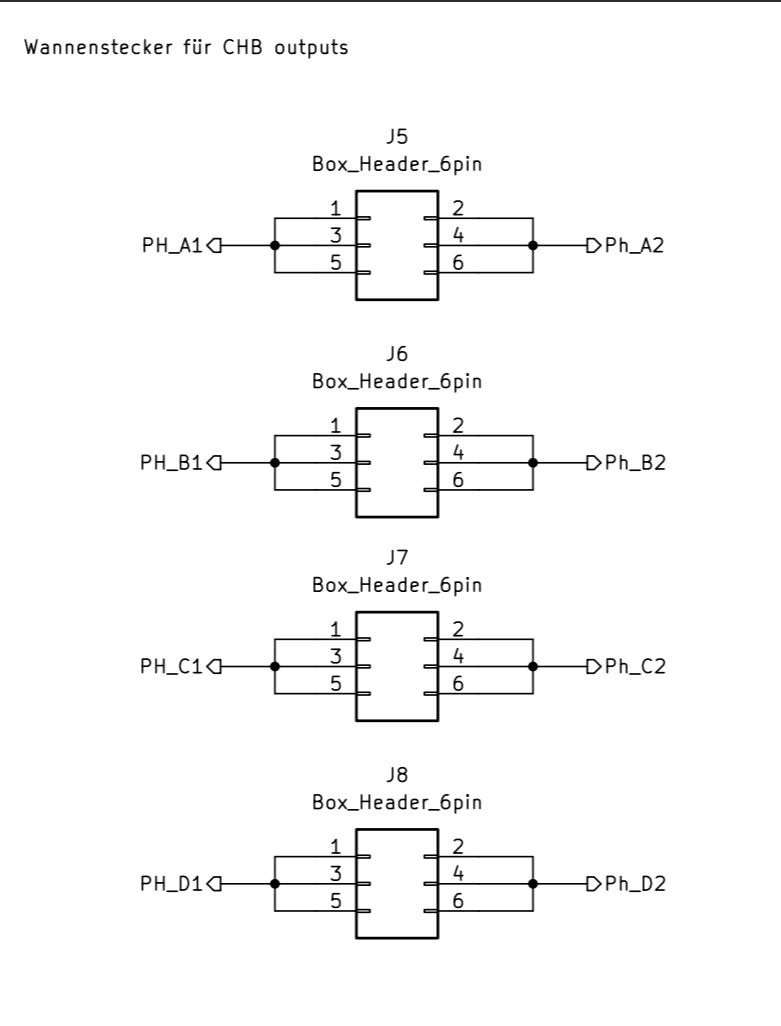
B

C

C

D

D



Sheet: /Power from CHB/
File: power_from_chb.kicad_sch

Title:

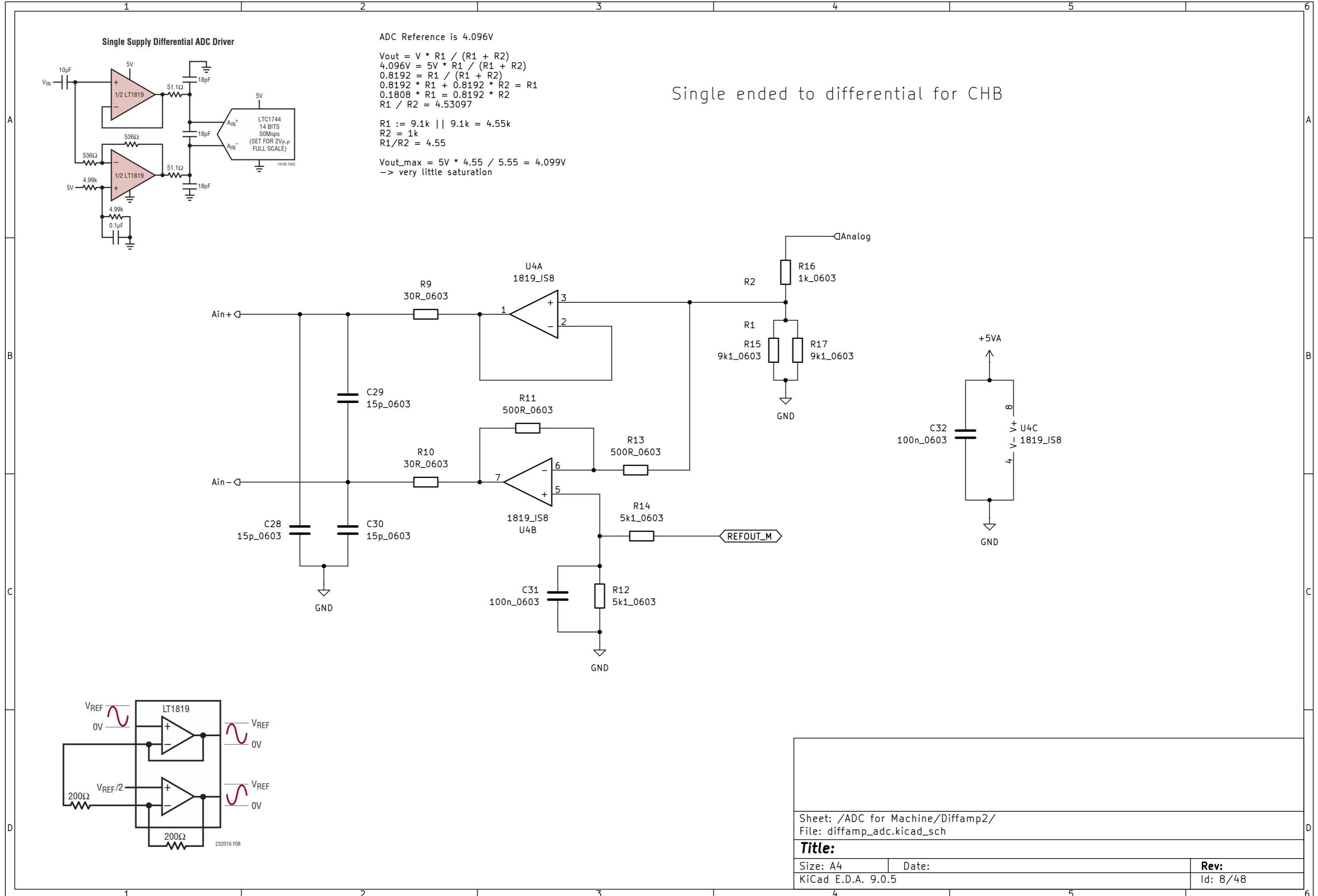
Size: A4 Date:

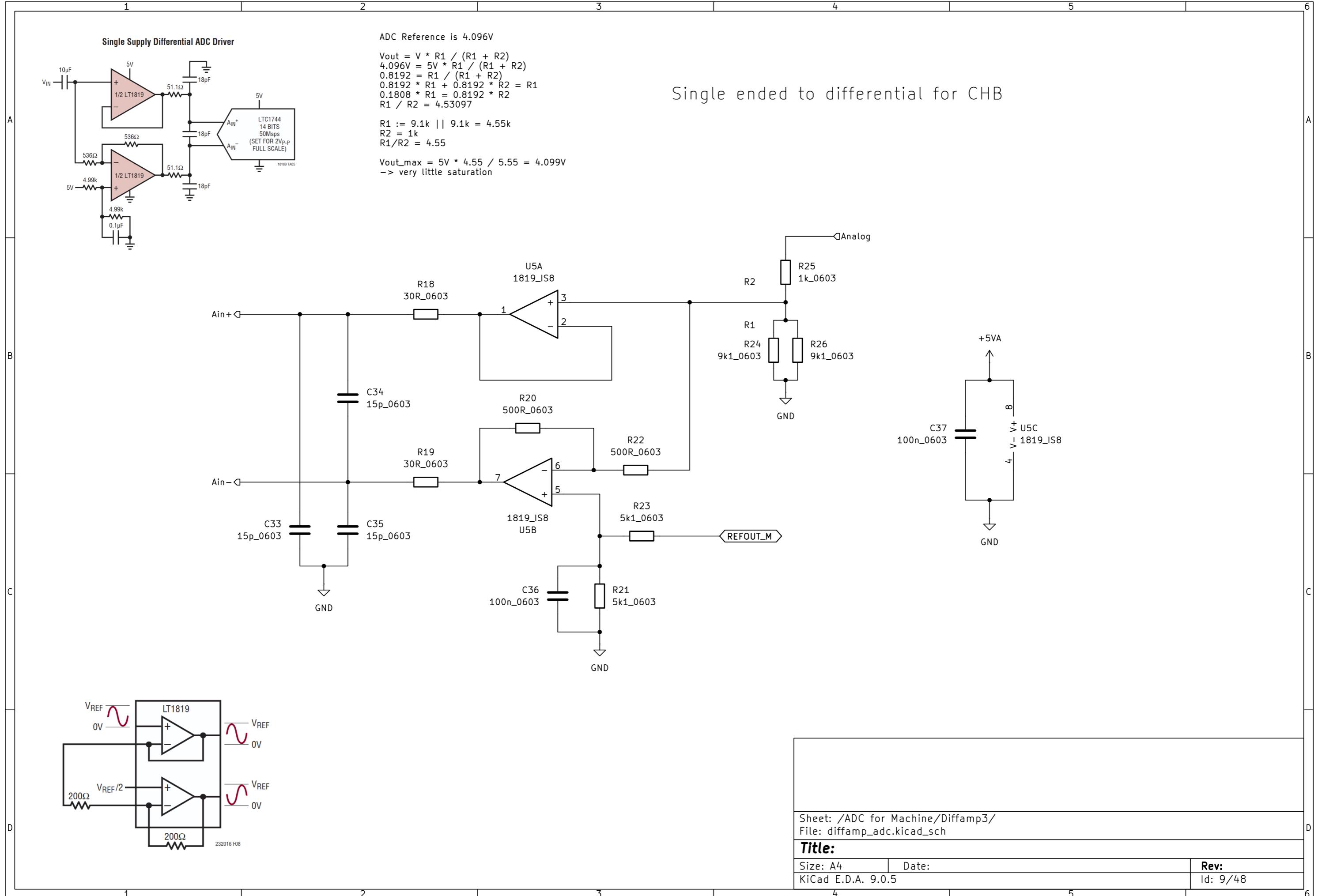
KiCad E.D.A. 9.0.5

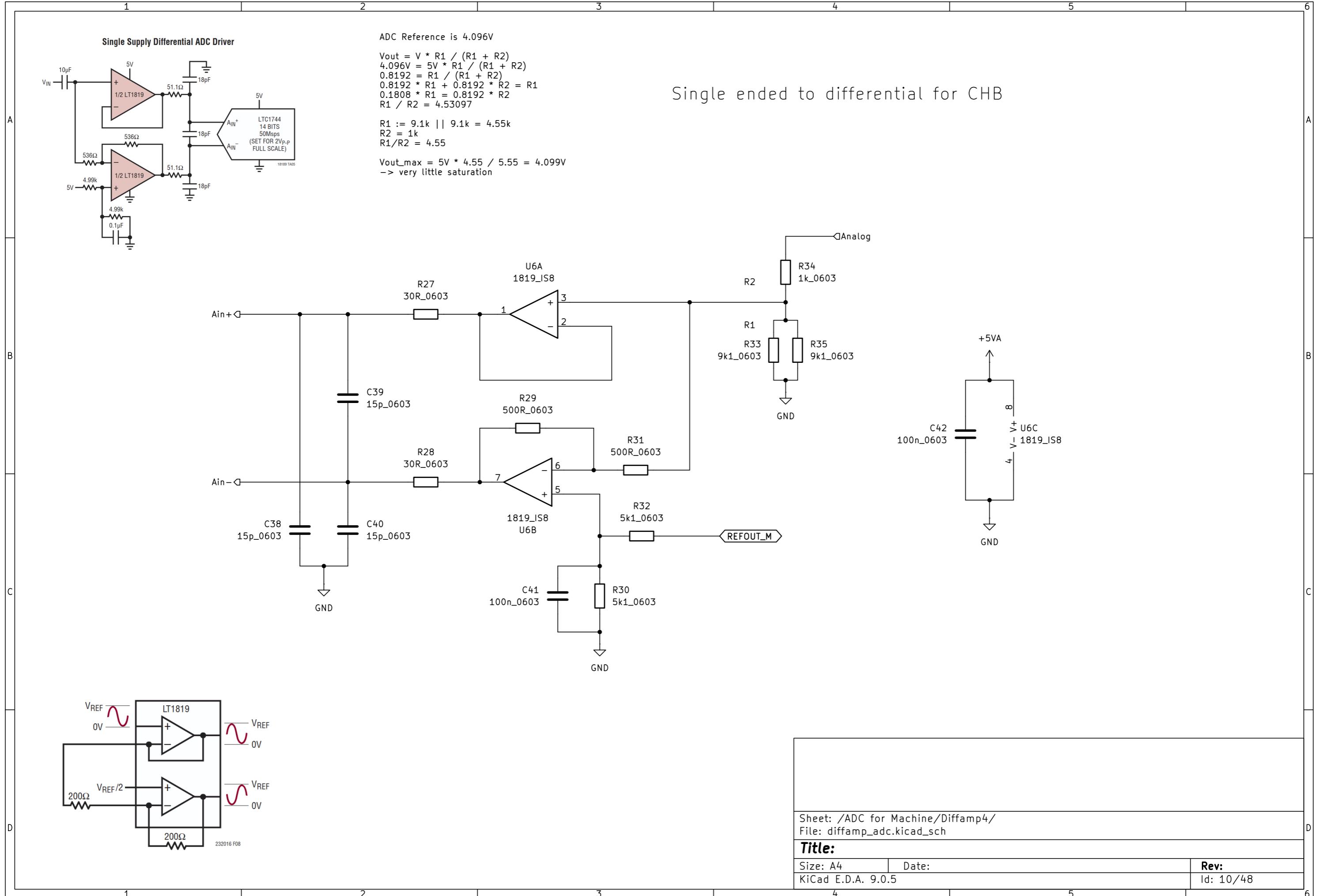
Rev:

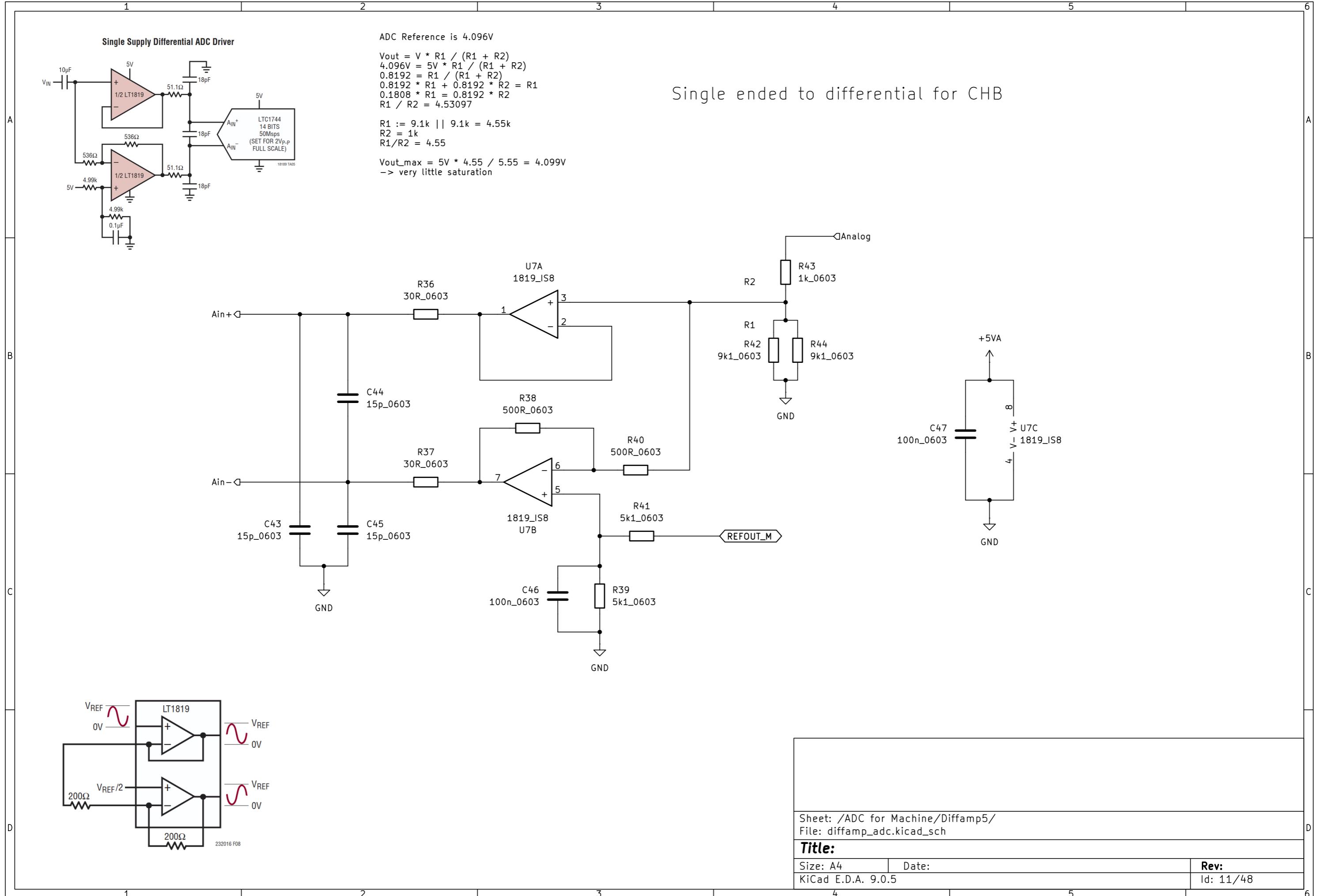
Id: 7/48

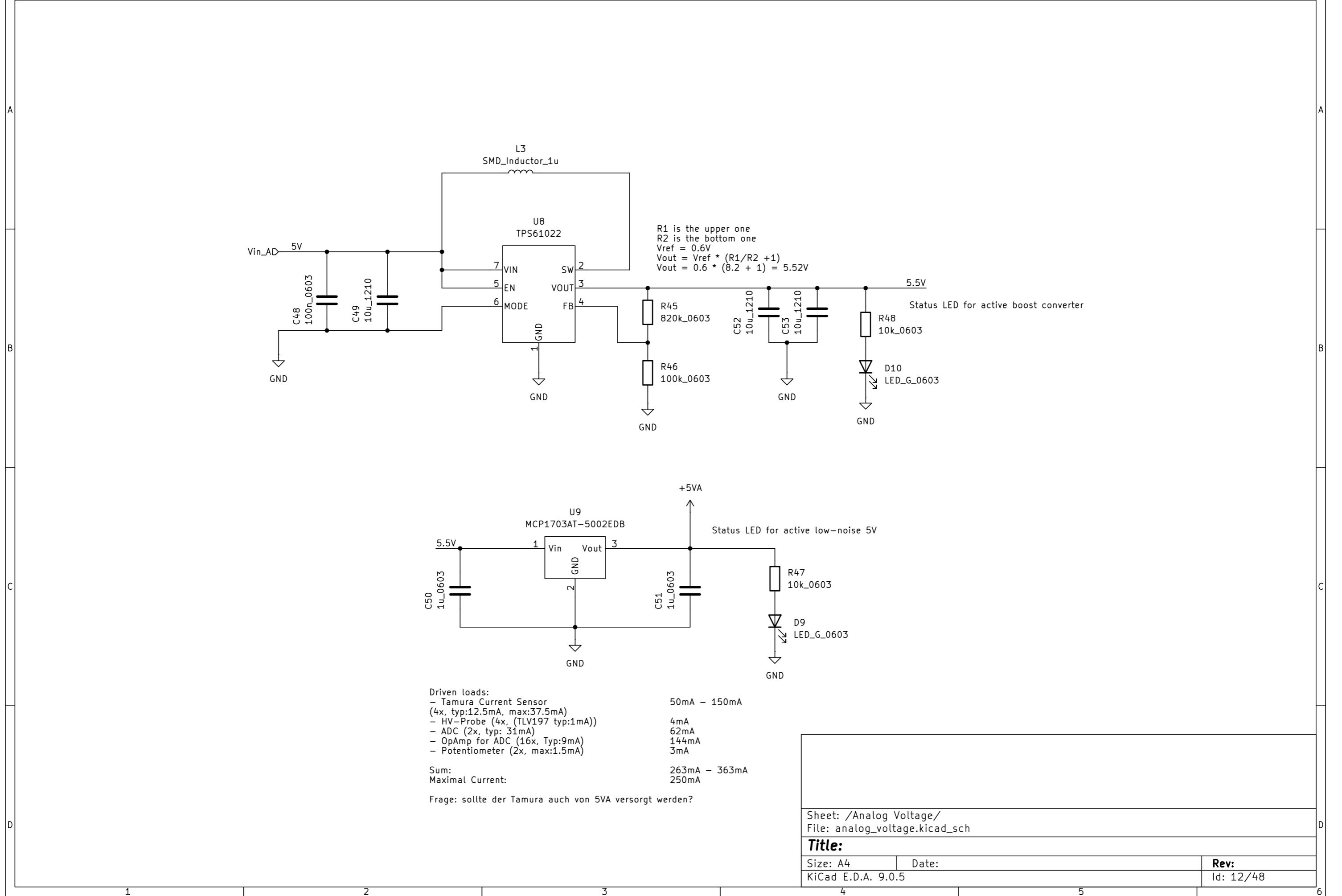
1 2 3 4 5 6

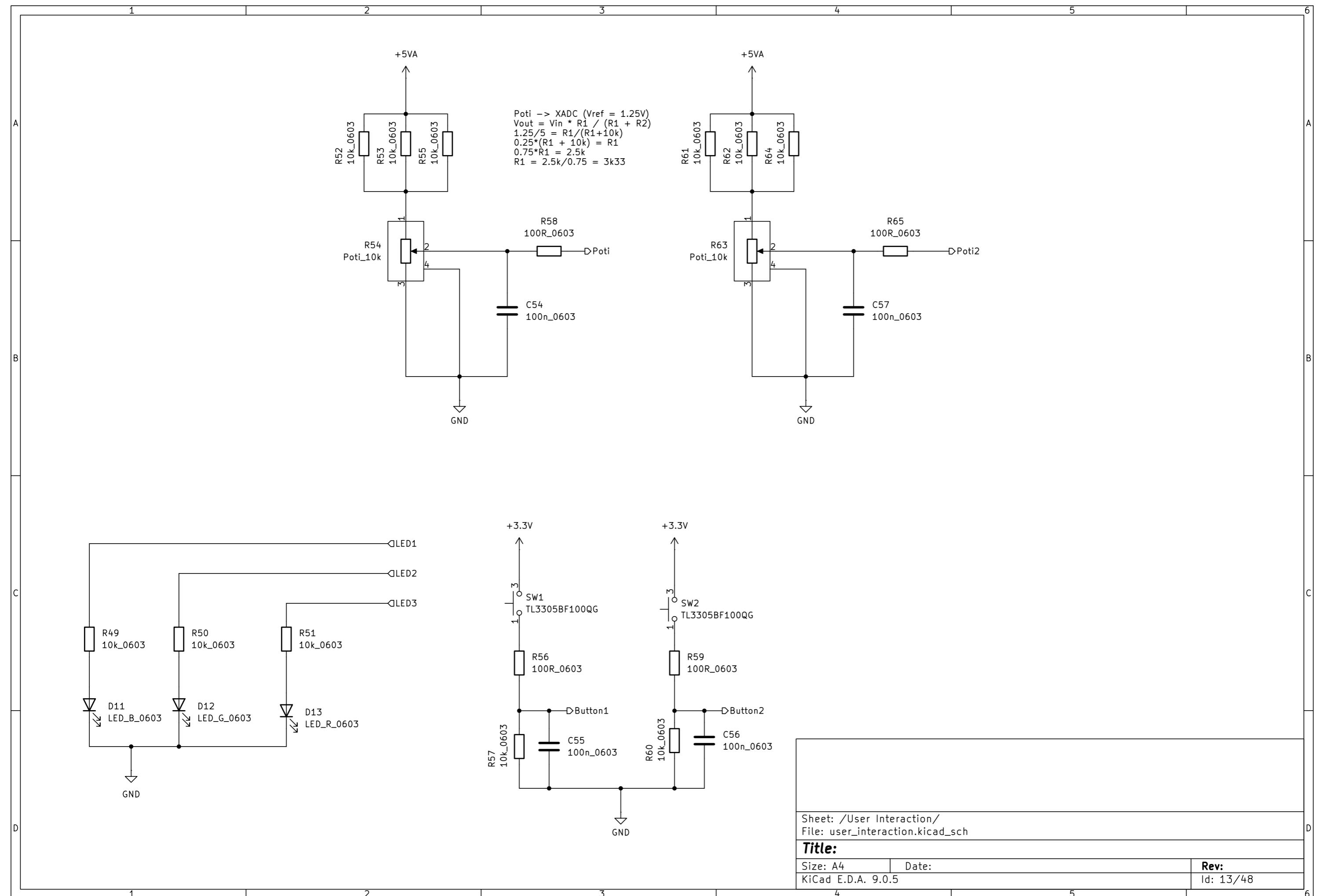


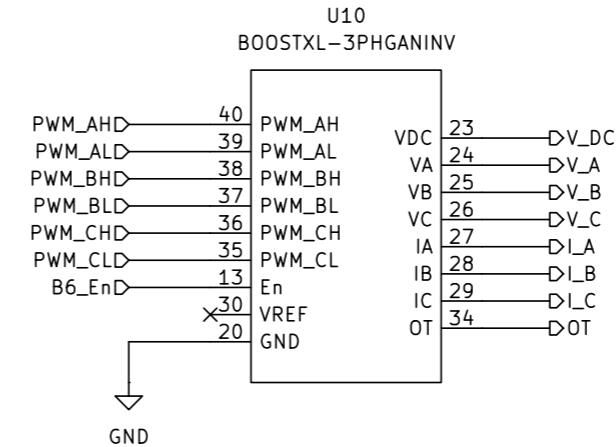
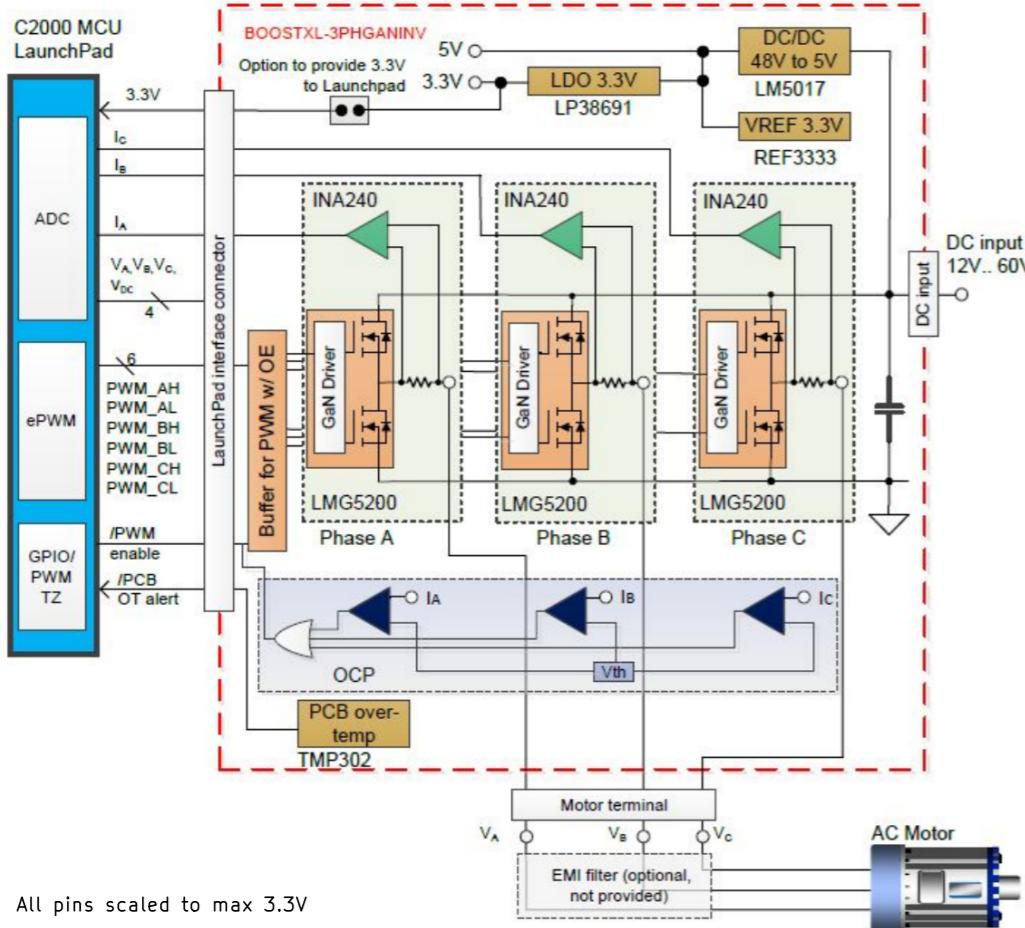




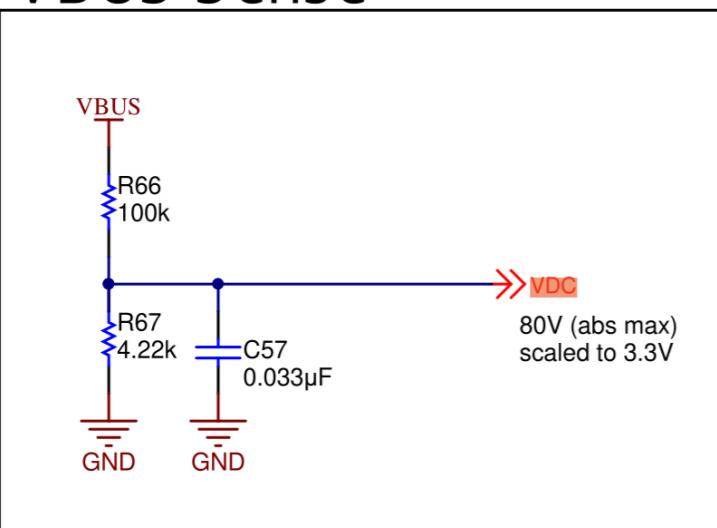








VBUS Sense



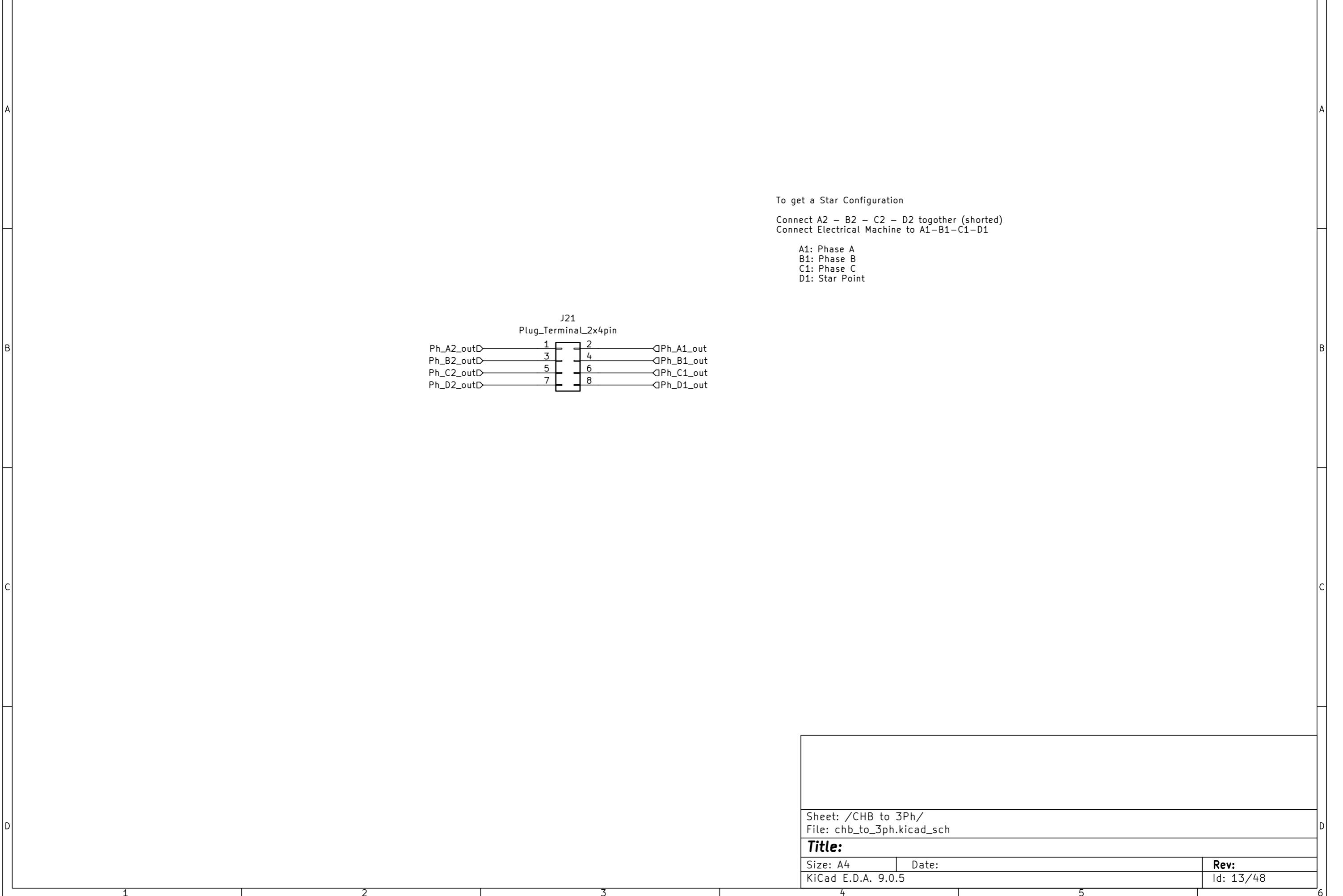
Sheet: /TI-B6/
File: ti_b6.kicad_sch

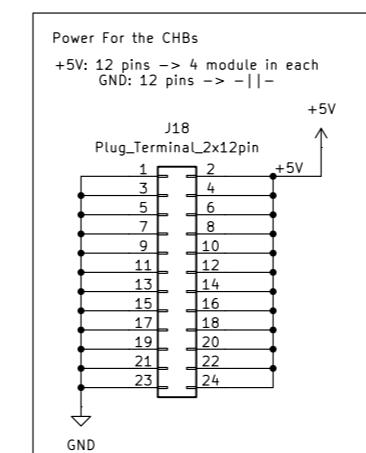
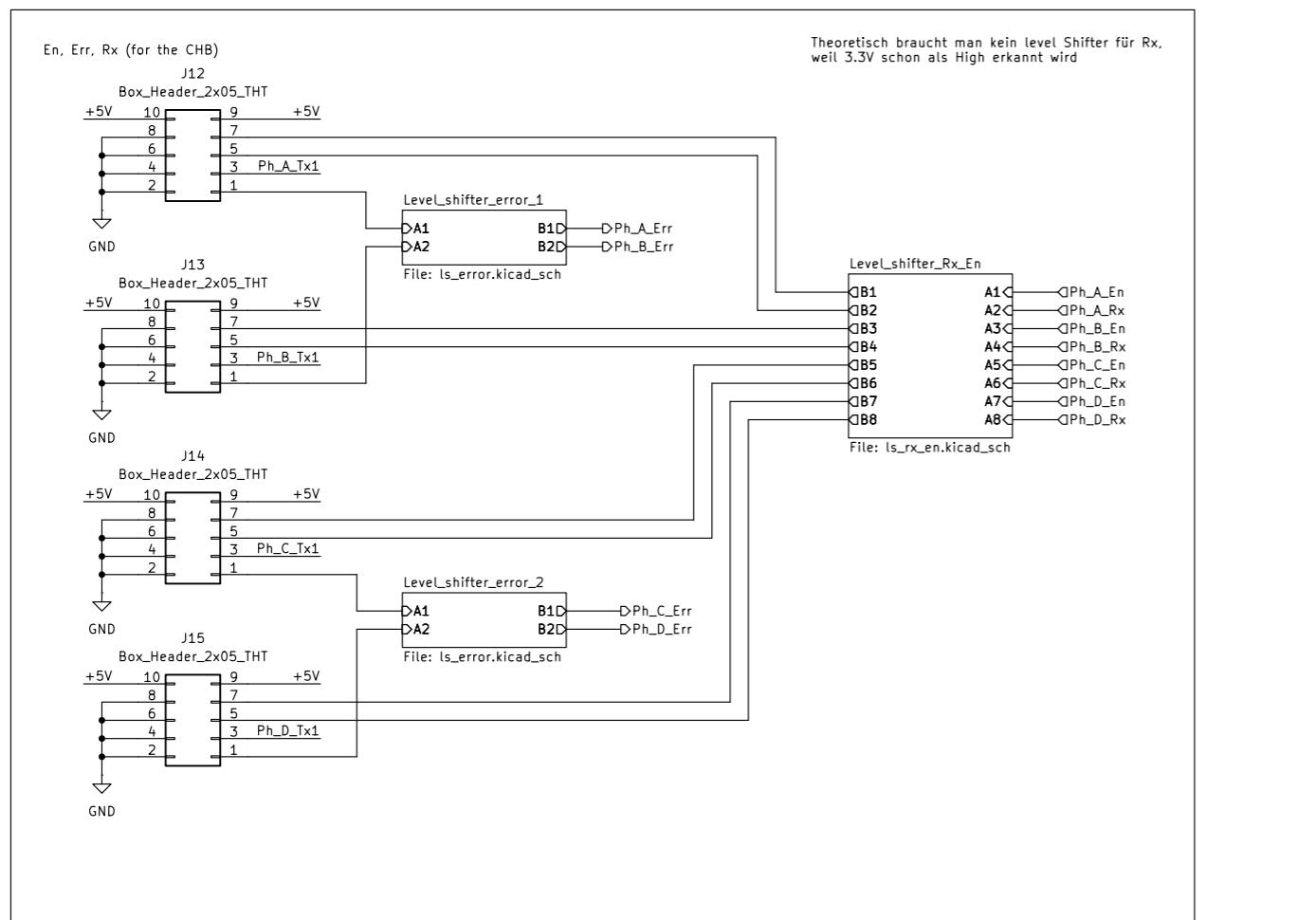
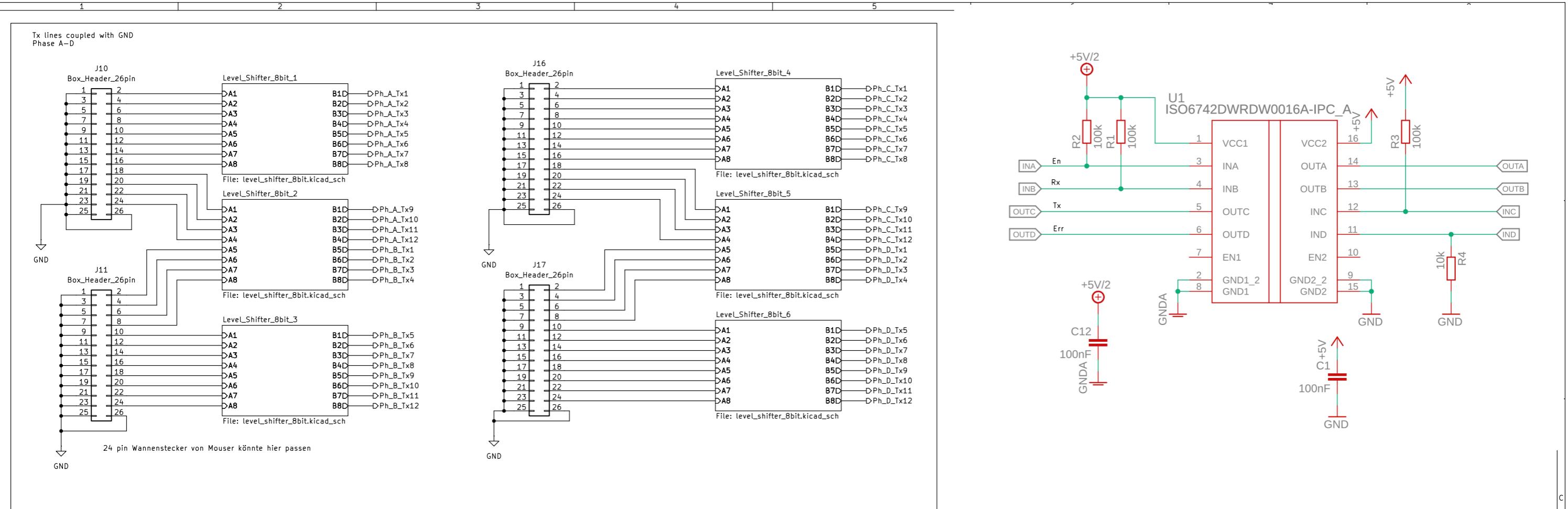
Title:

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

Rev:
Id: 13/48

1 2 3 4 5 6



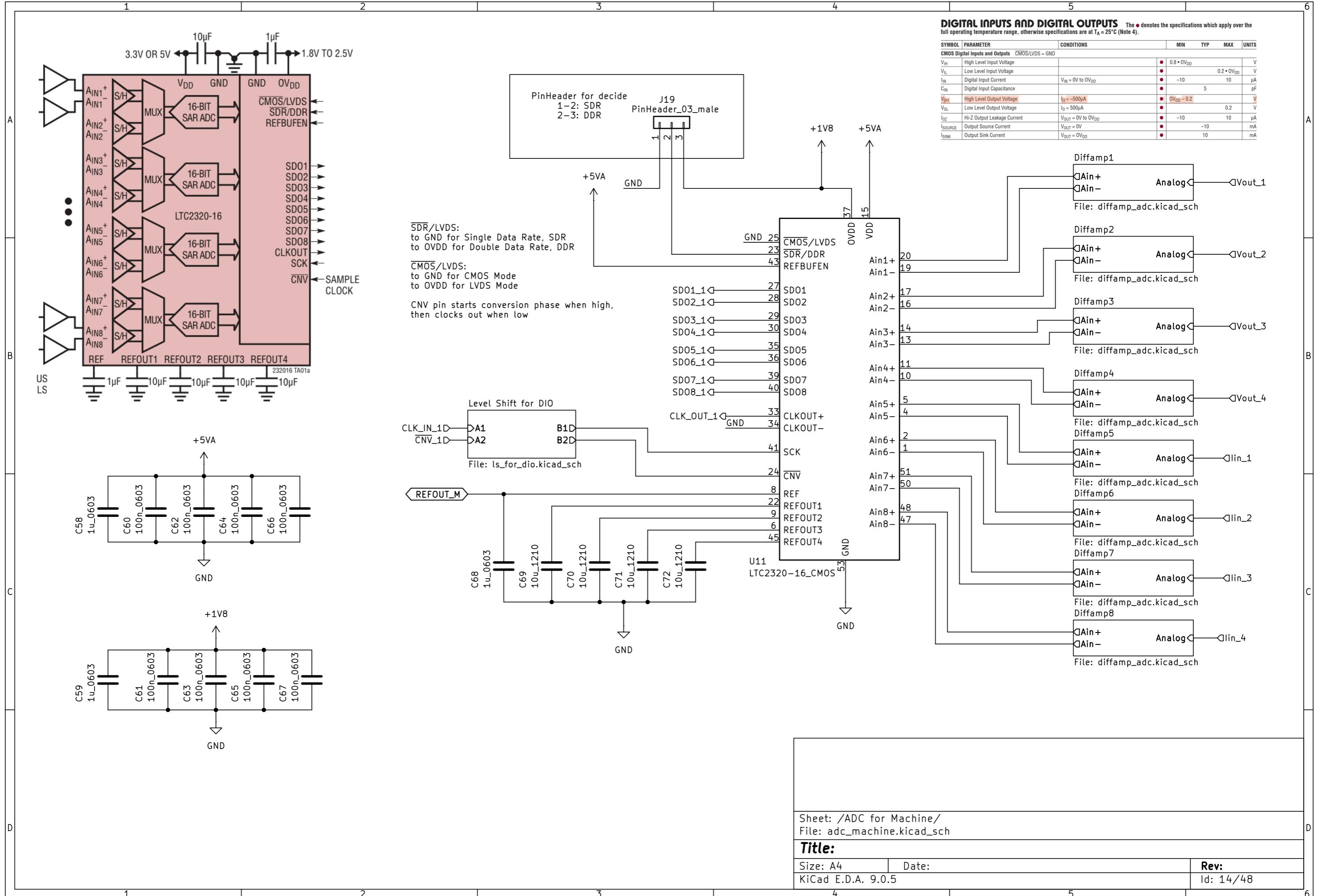


Sheet: /CHB Communication/
File: chb_com.kicad_sch

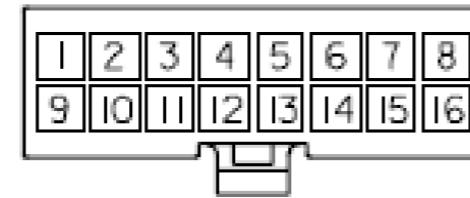
Title:

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

Rev:
Id: 14/48



1 2 3 4 5 6

Molex® Mini-Fit Jr.™

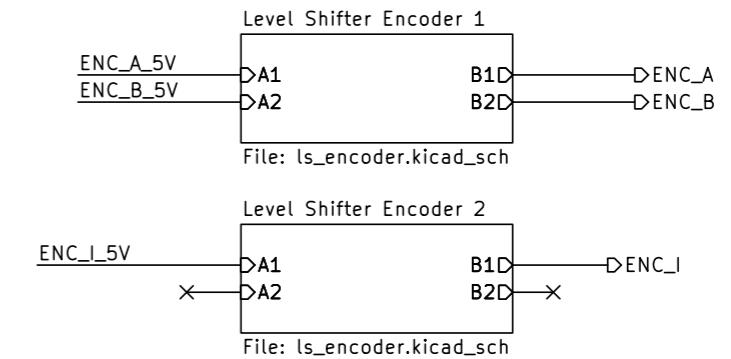
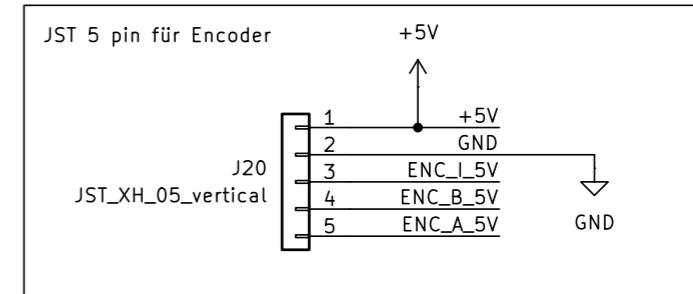
(Wire Entry View)

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)



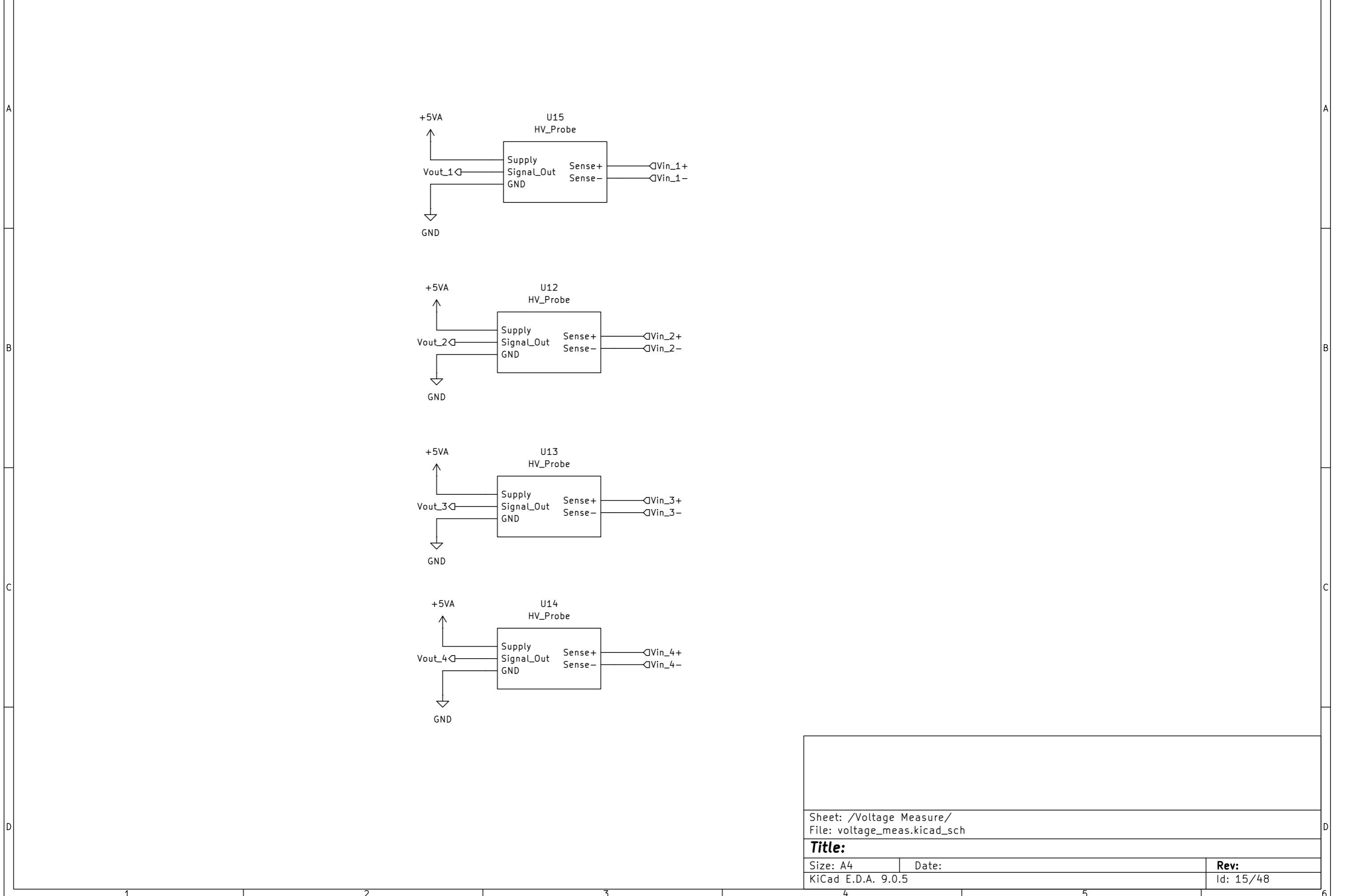
Sheet: /Encoder/
 File: encoder.kicad_sch

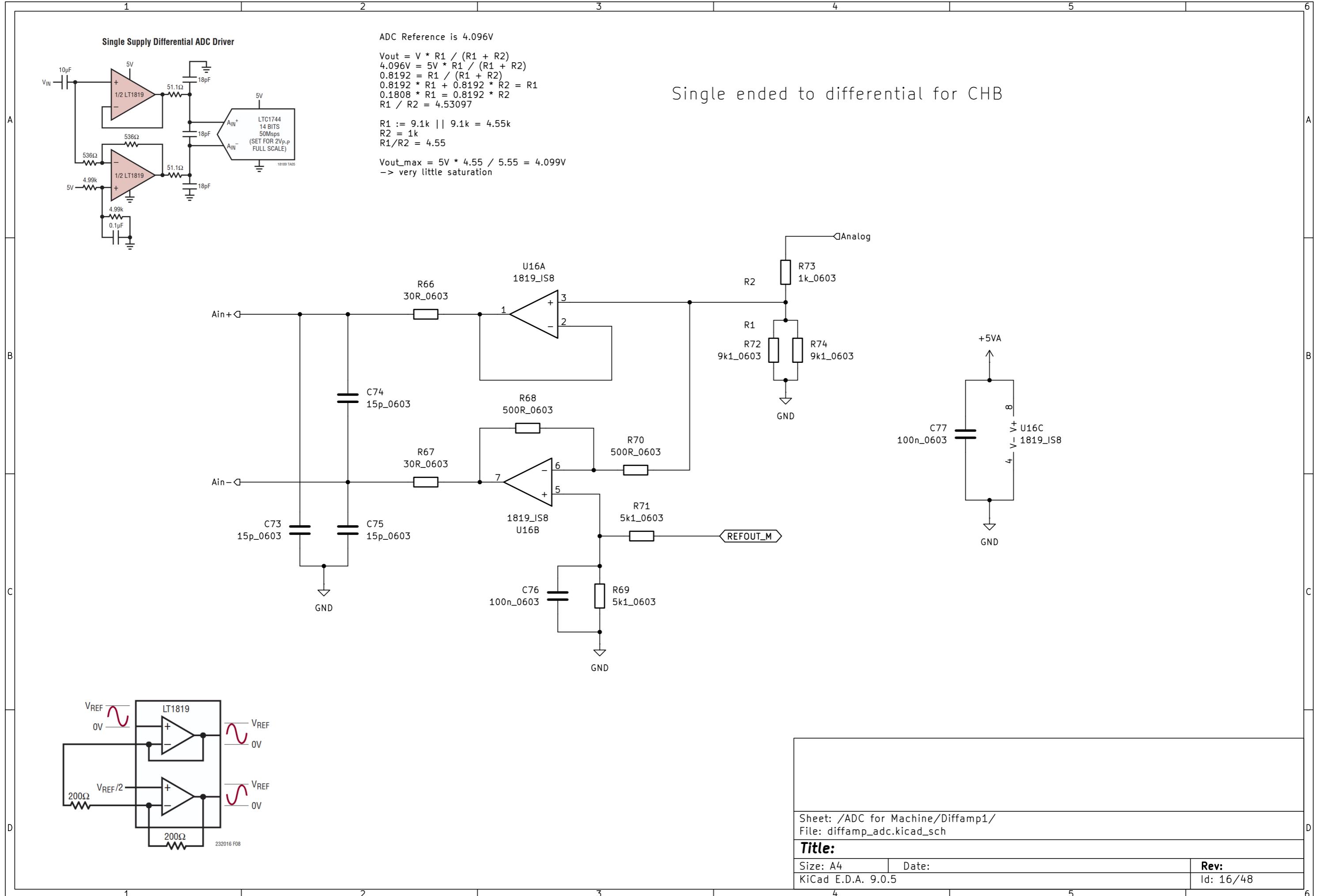
Title:

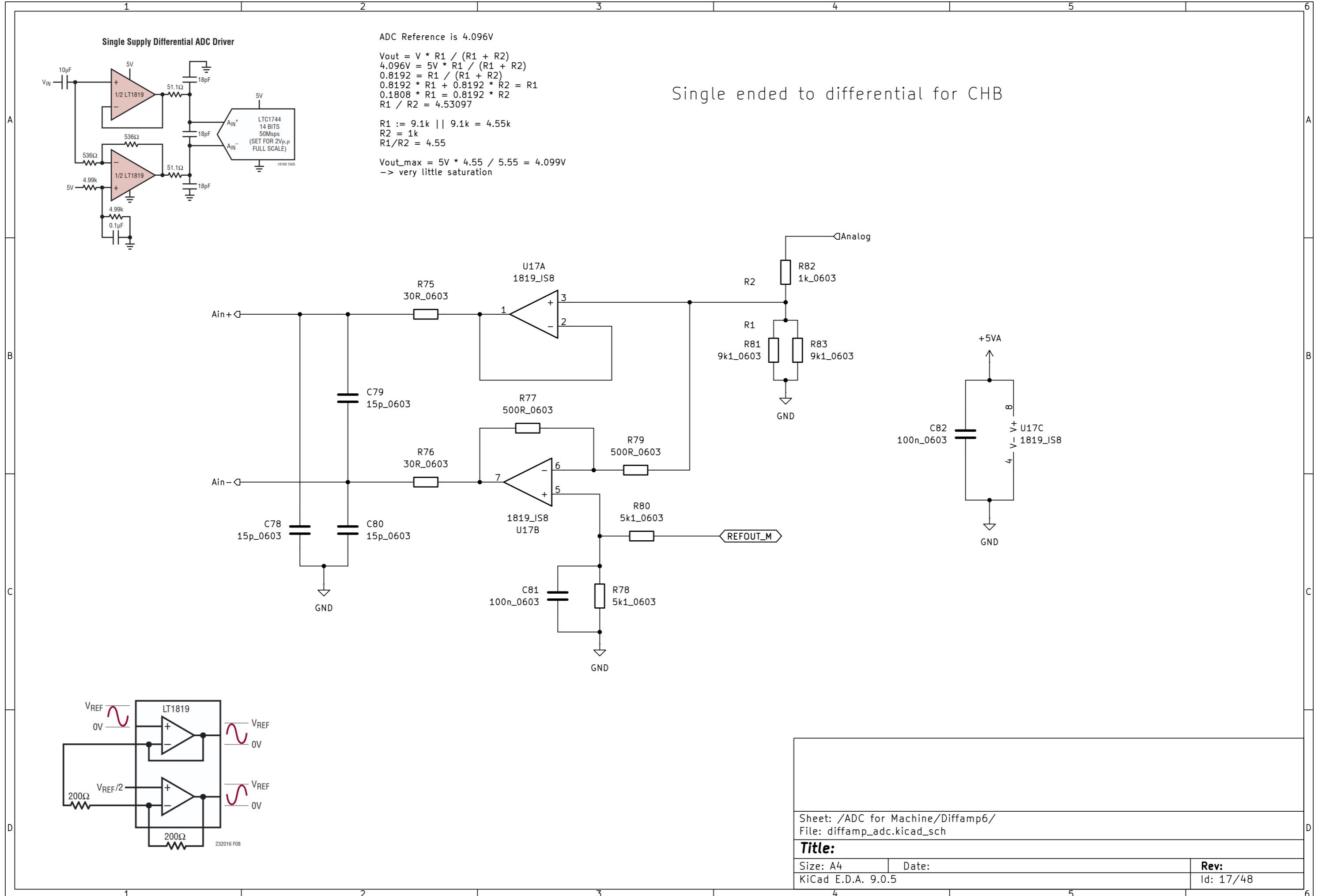
Size: A4 Date:
 KiCad E.D.A. 9.0.5

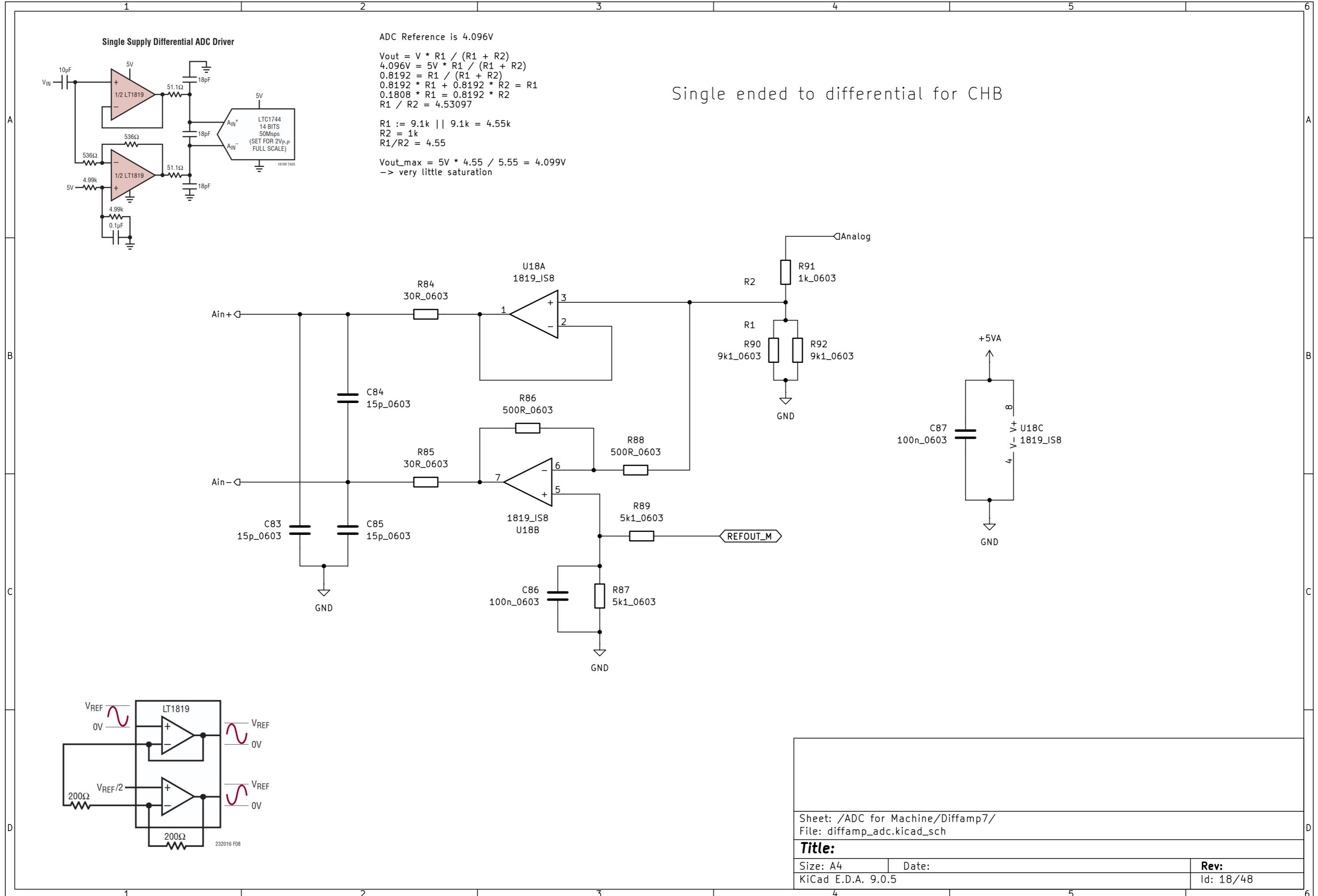
Rev:
 Id: 15/48

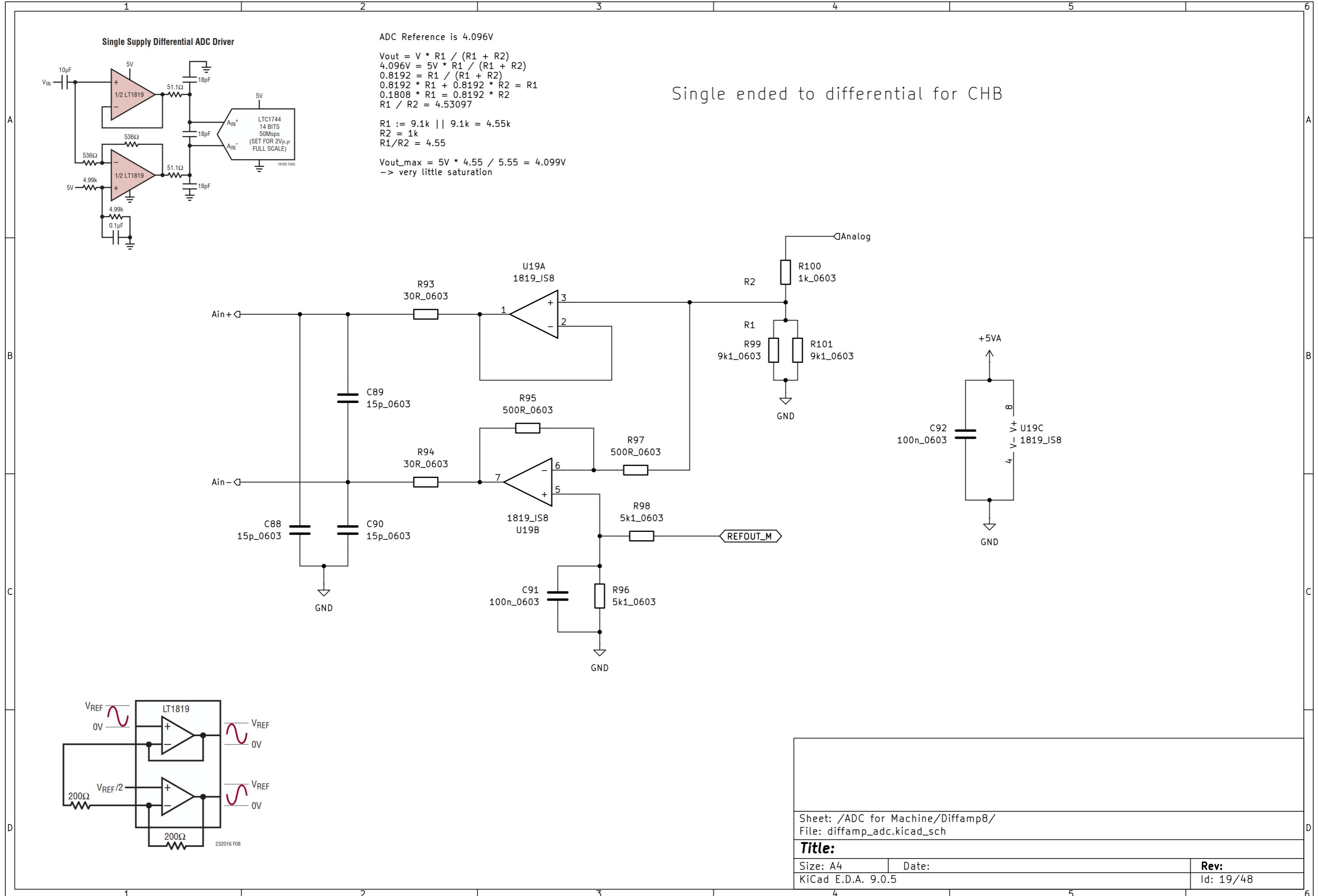
1 2 3 4 5 6

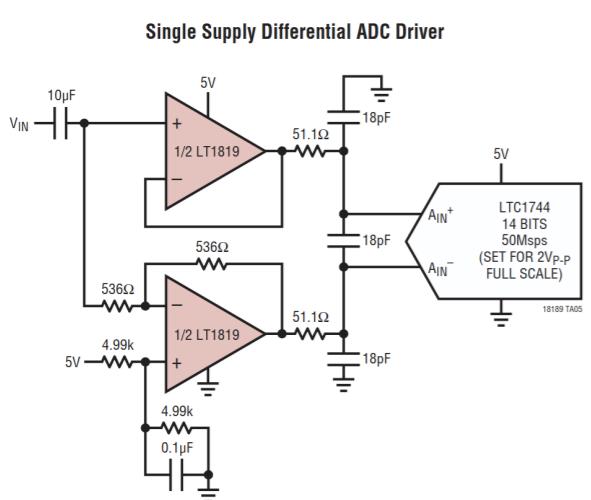










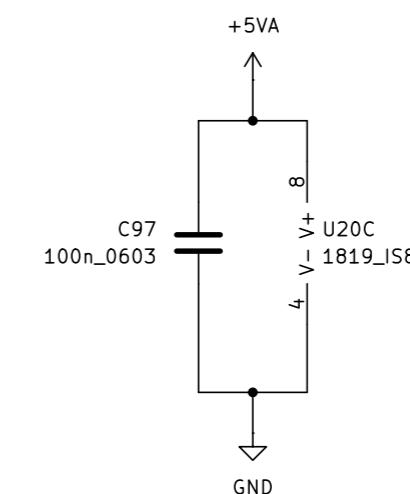
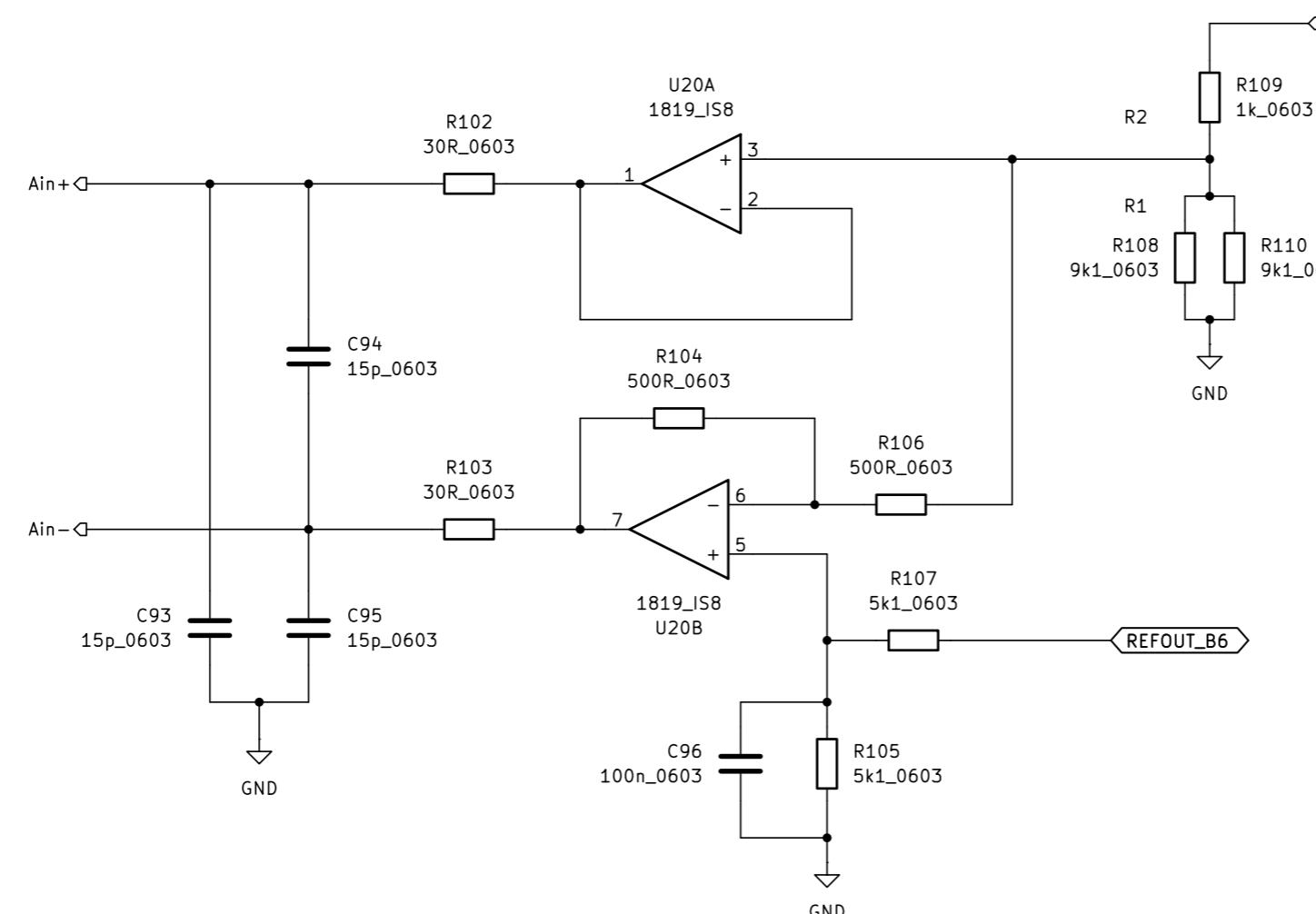
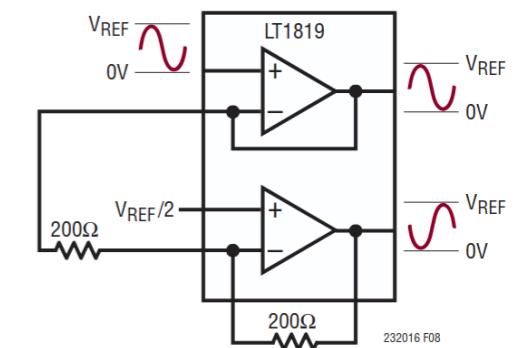


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

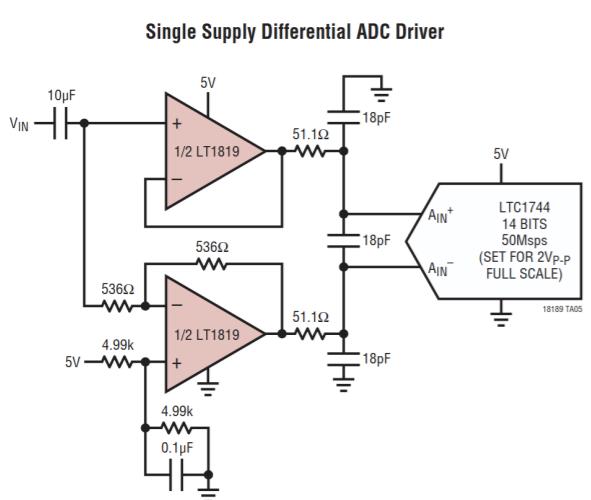


Sheet: /ADC for B6/Diffamp_2/
File: diffamp_.kicad_sch

Title:

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

Rev:
Id: 20/48

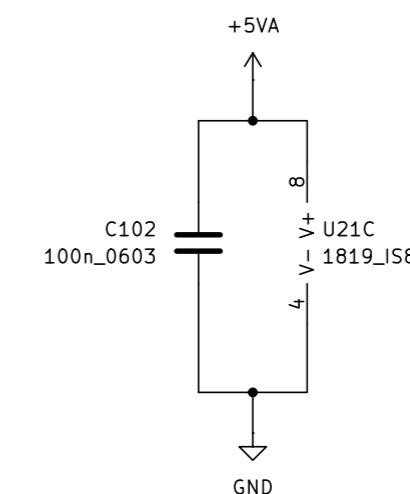
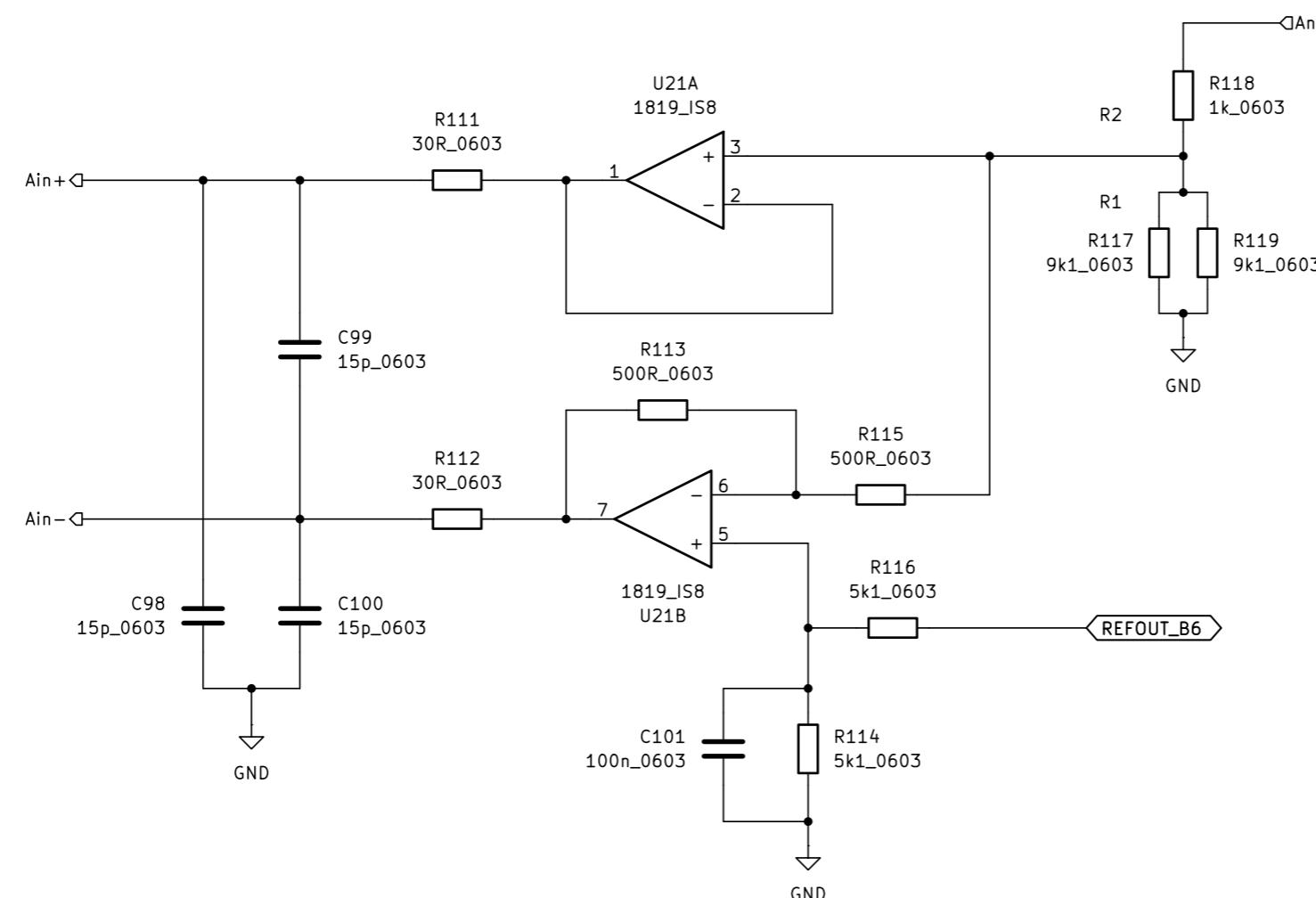
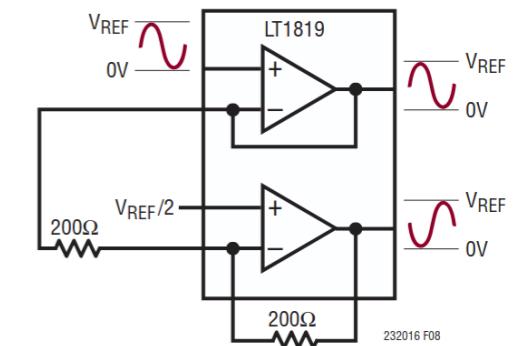


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

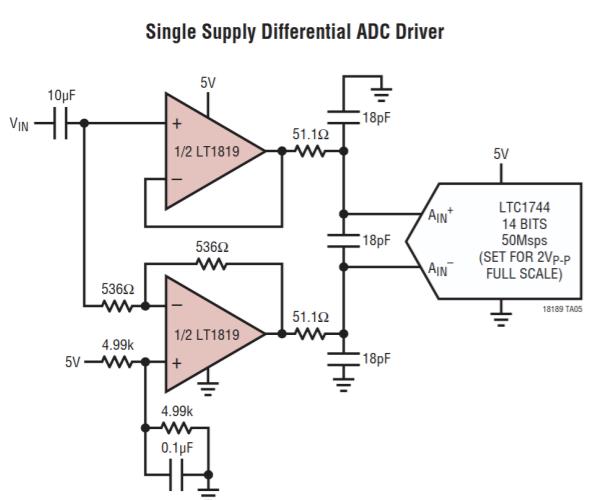


Sheet: /ADC for B6/Diffamp_3/
File: diffamp_.kicad_sch

Title:

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

Rev:
Id: 21/48

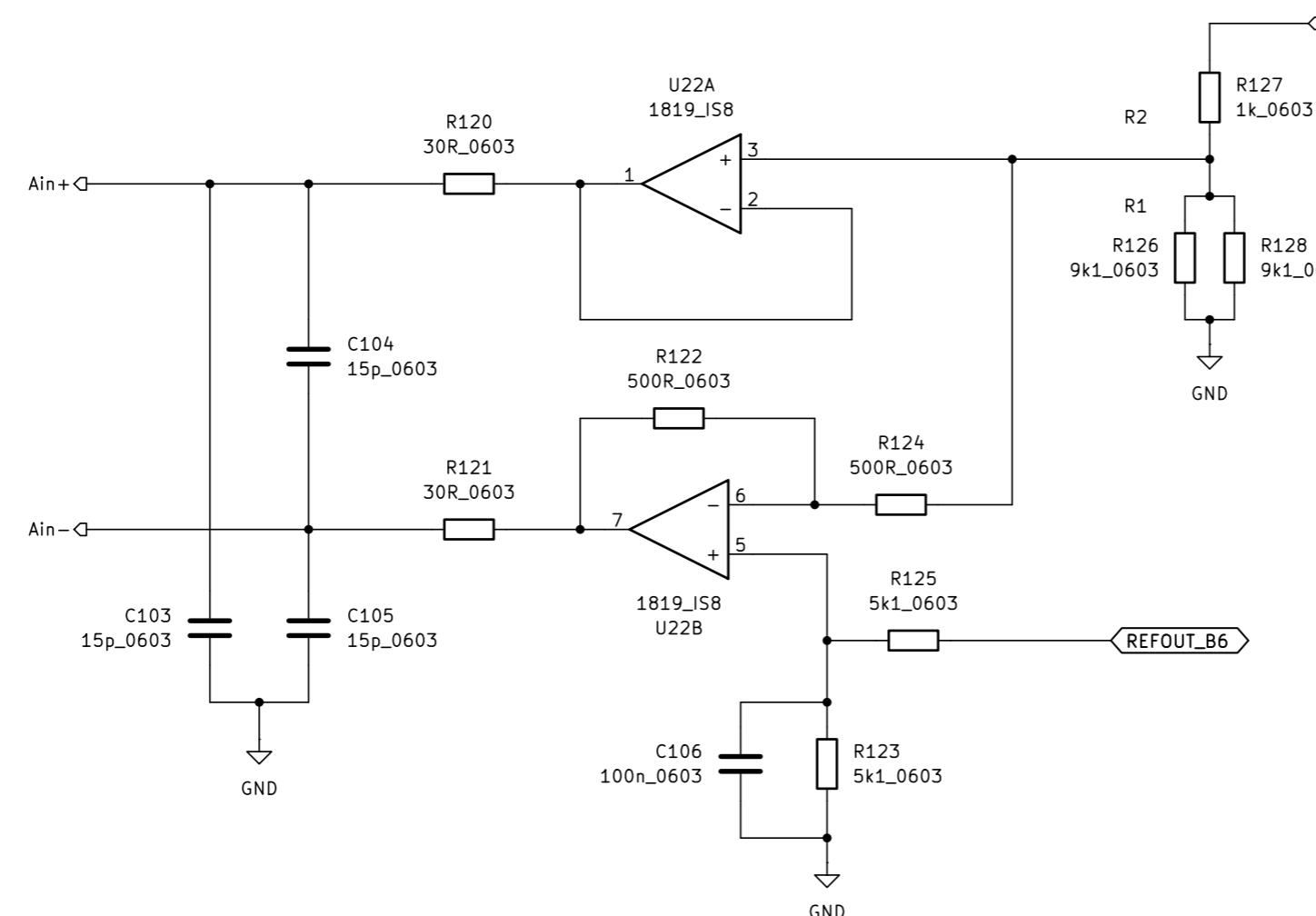
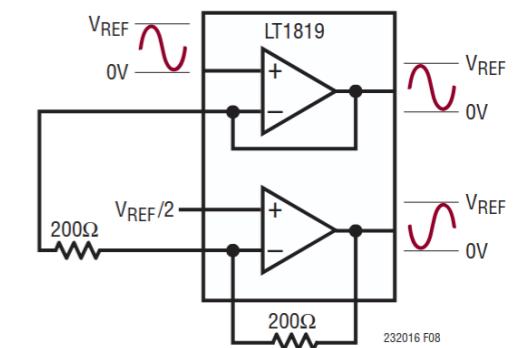


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

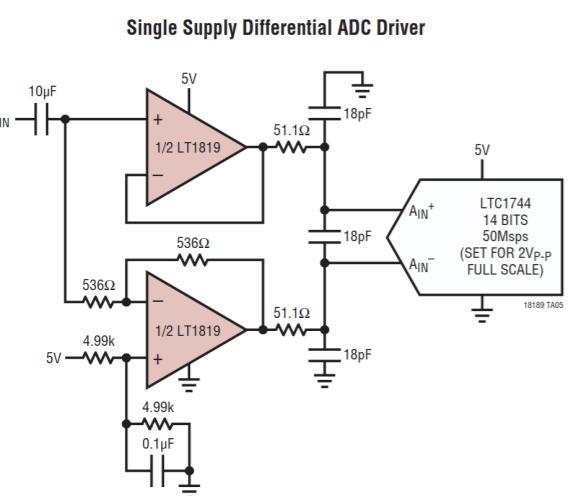


Sheet: /ADC for B6/Diffamp_4/
File: diffamp_.kicad_sch

Title:

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

Rev:
Id: 22/48

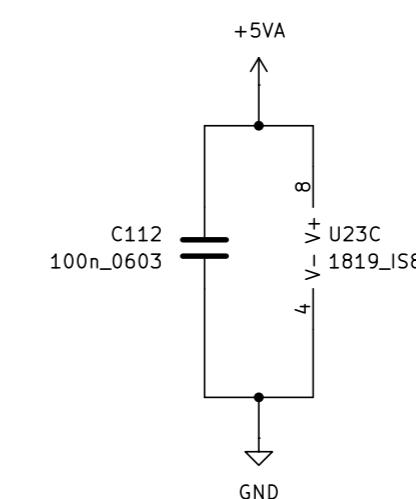
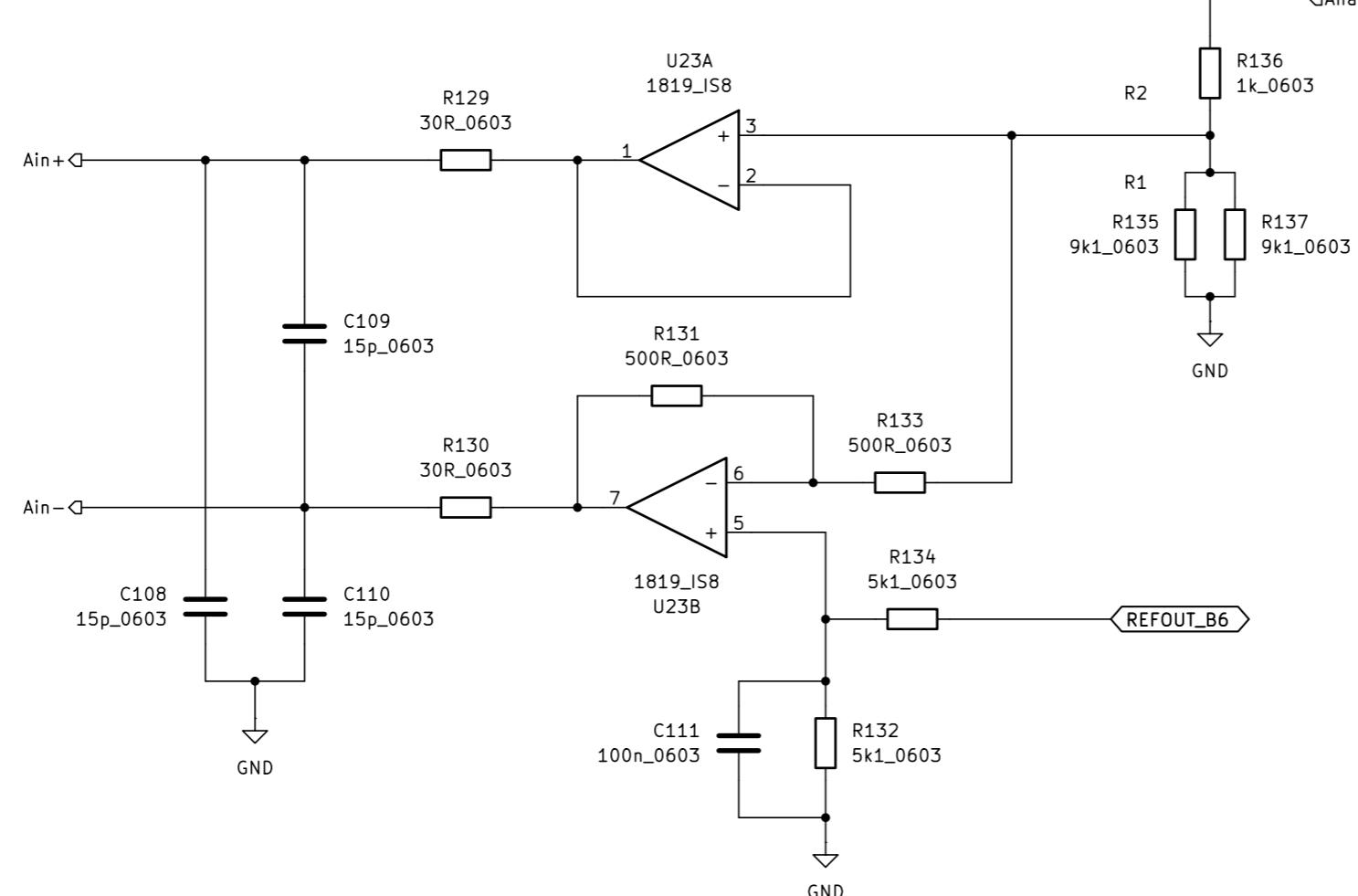
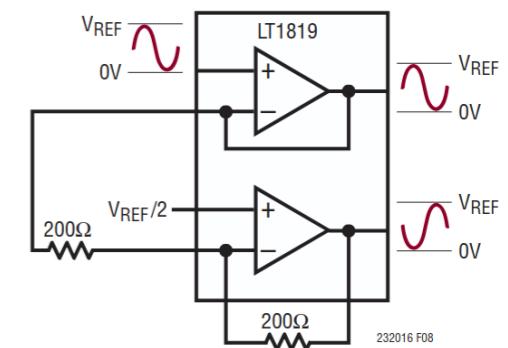


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

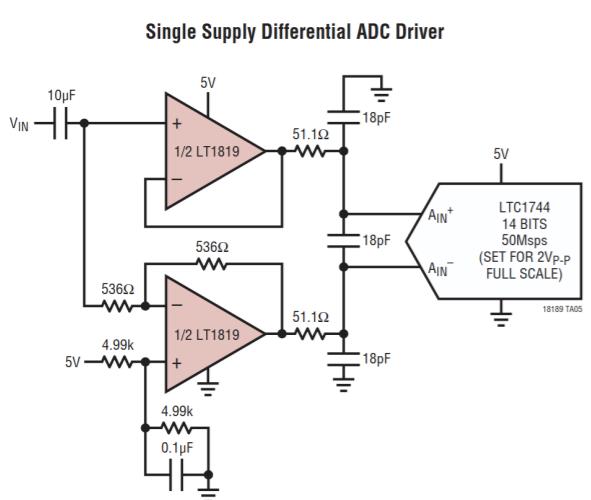


Sheet: /ADC for B6/Diffamp_5/
File: diffamp_.kicad_sch

Title:

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

Rev:
Id: 23/48

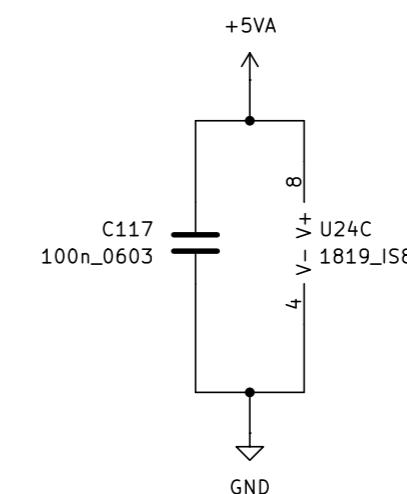
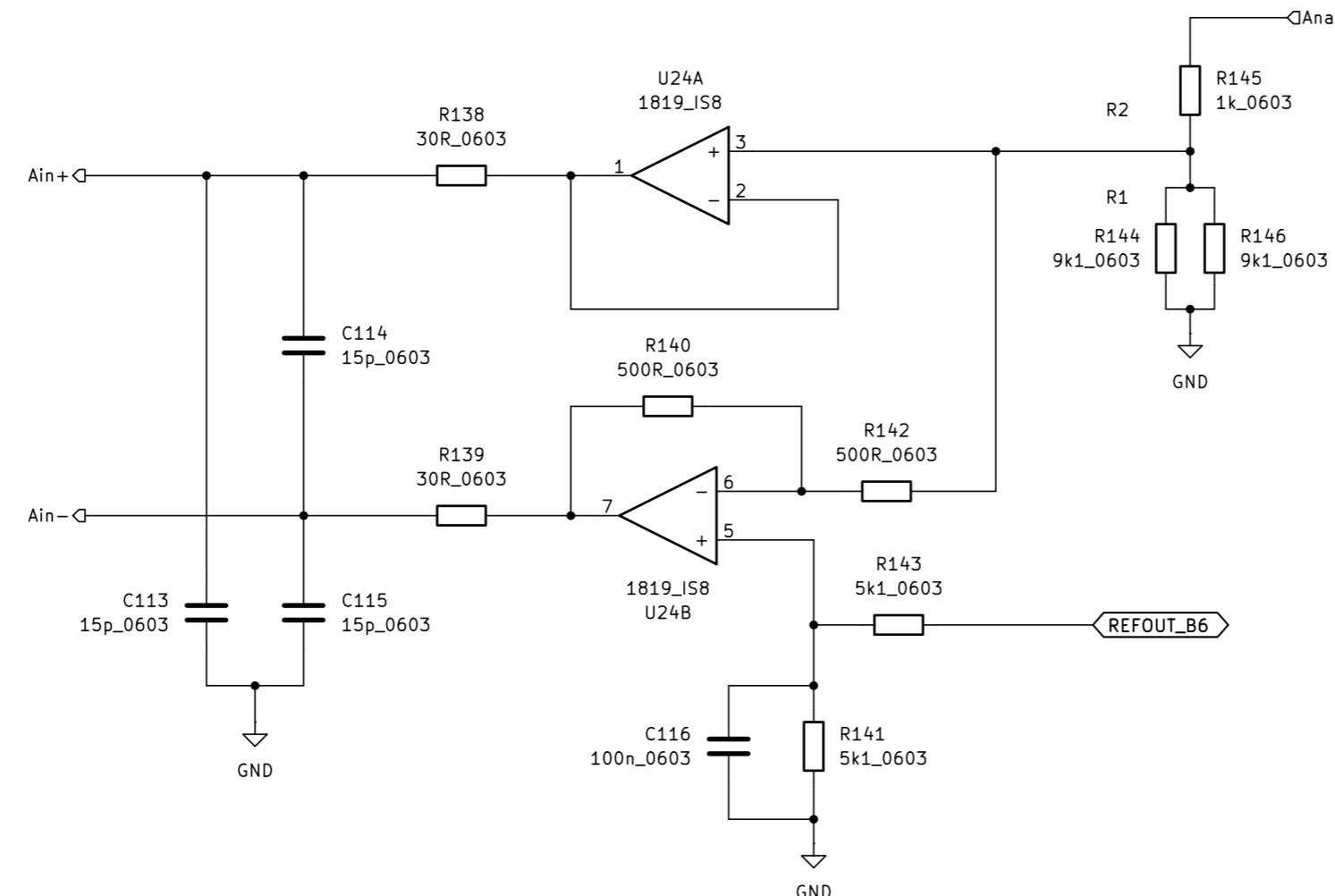
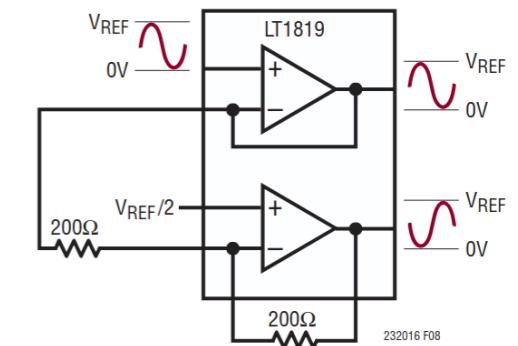


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

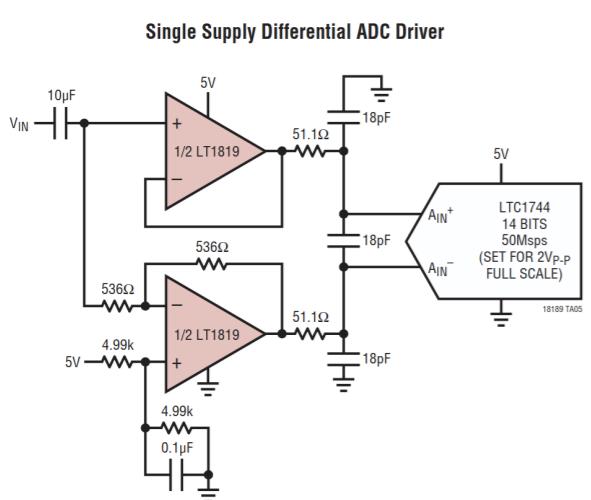


Sheet: /ADC for B6/Diffamp_6/
File: diffamp_.kicad_sch

Title:

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

Rev:
Id: 24/48

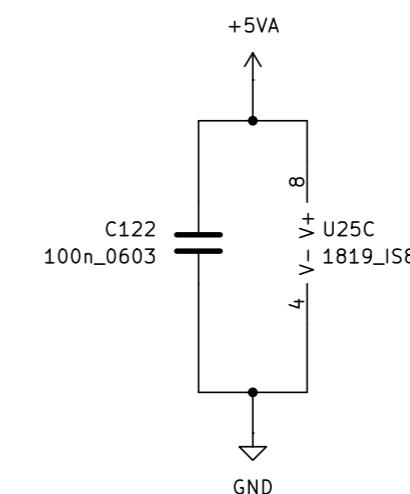
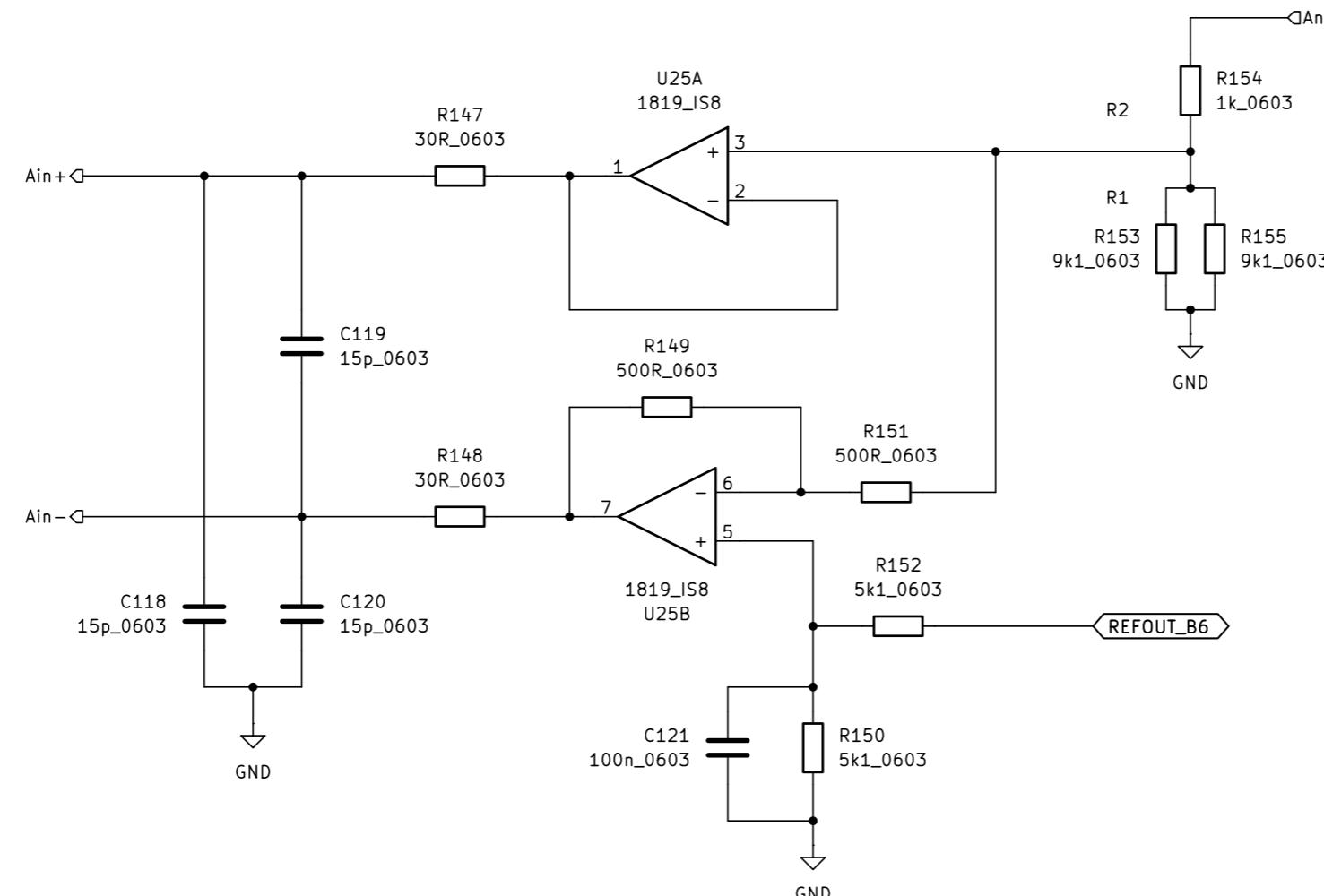
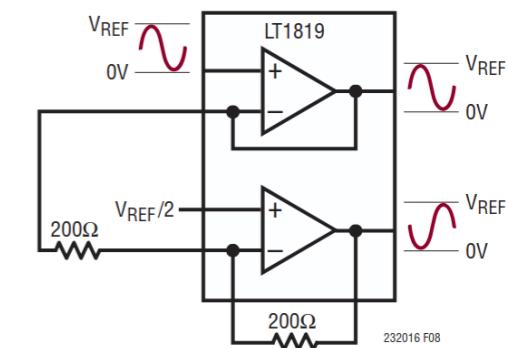


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

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

Single ended to differential for B6

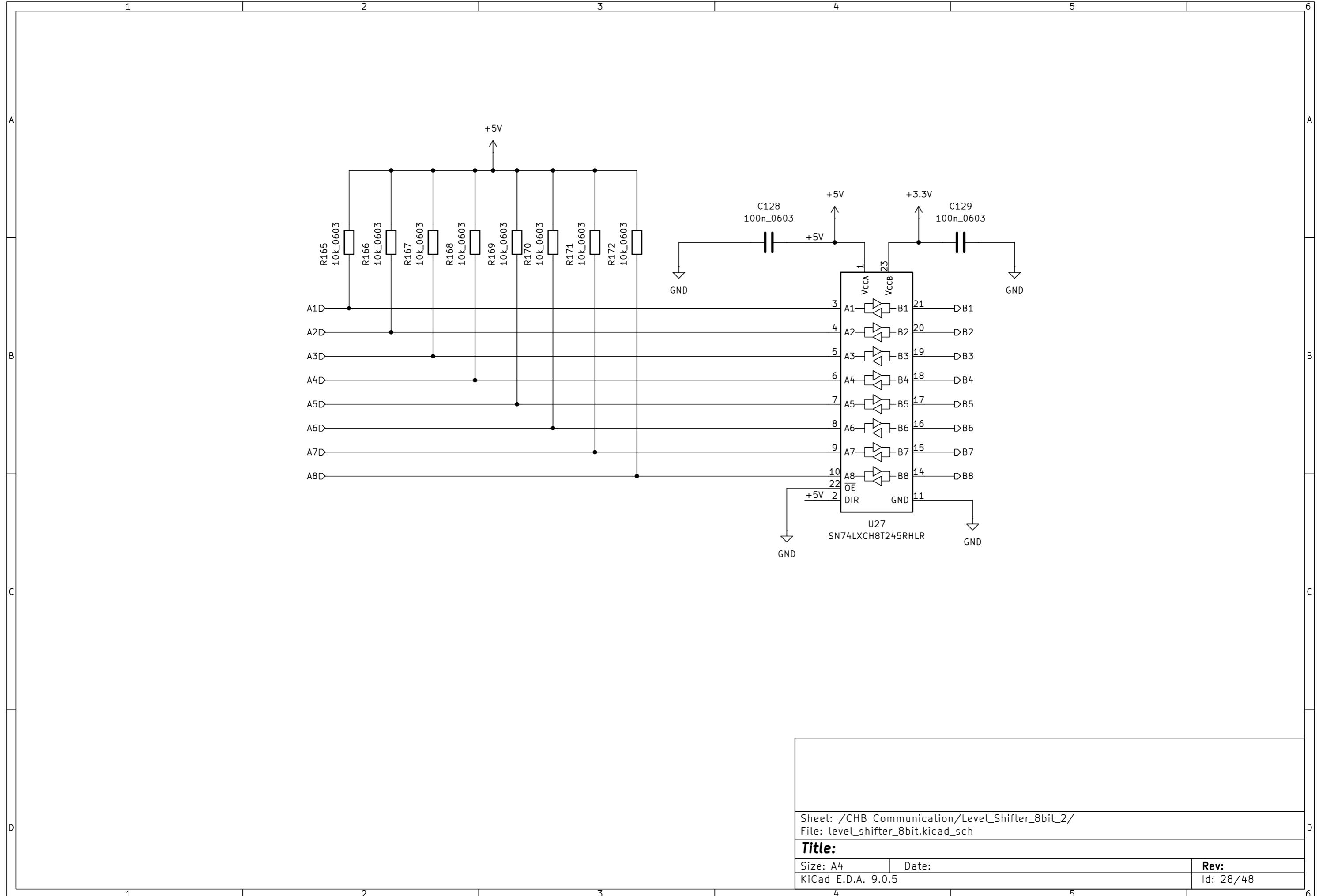


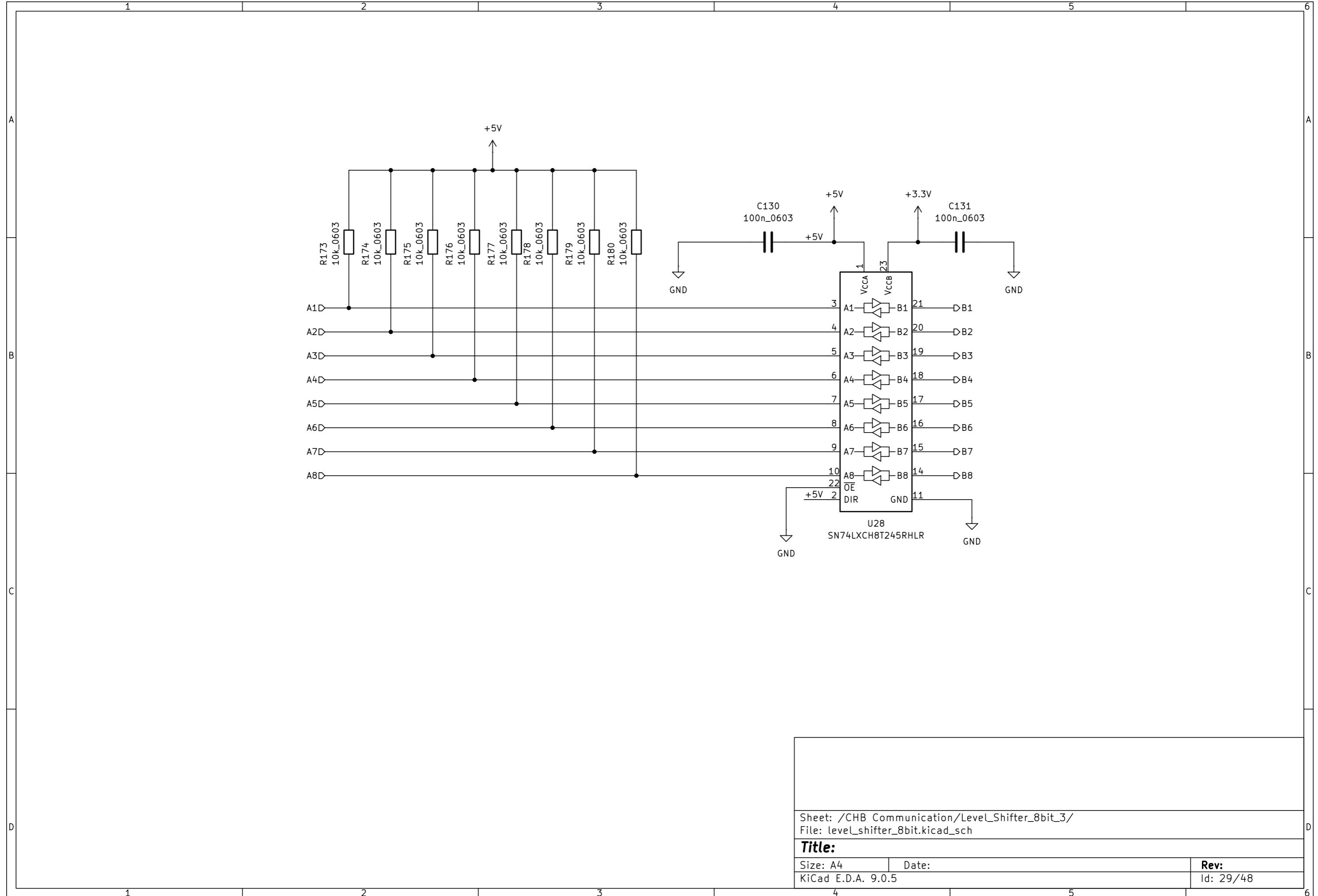
Sheet: /ADC for B6/Diffamp_7/
File: diffamp_.kicad_sch

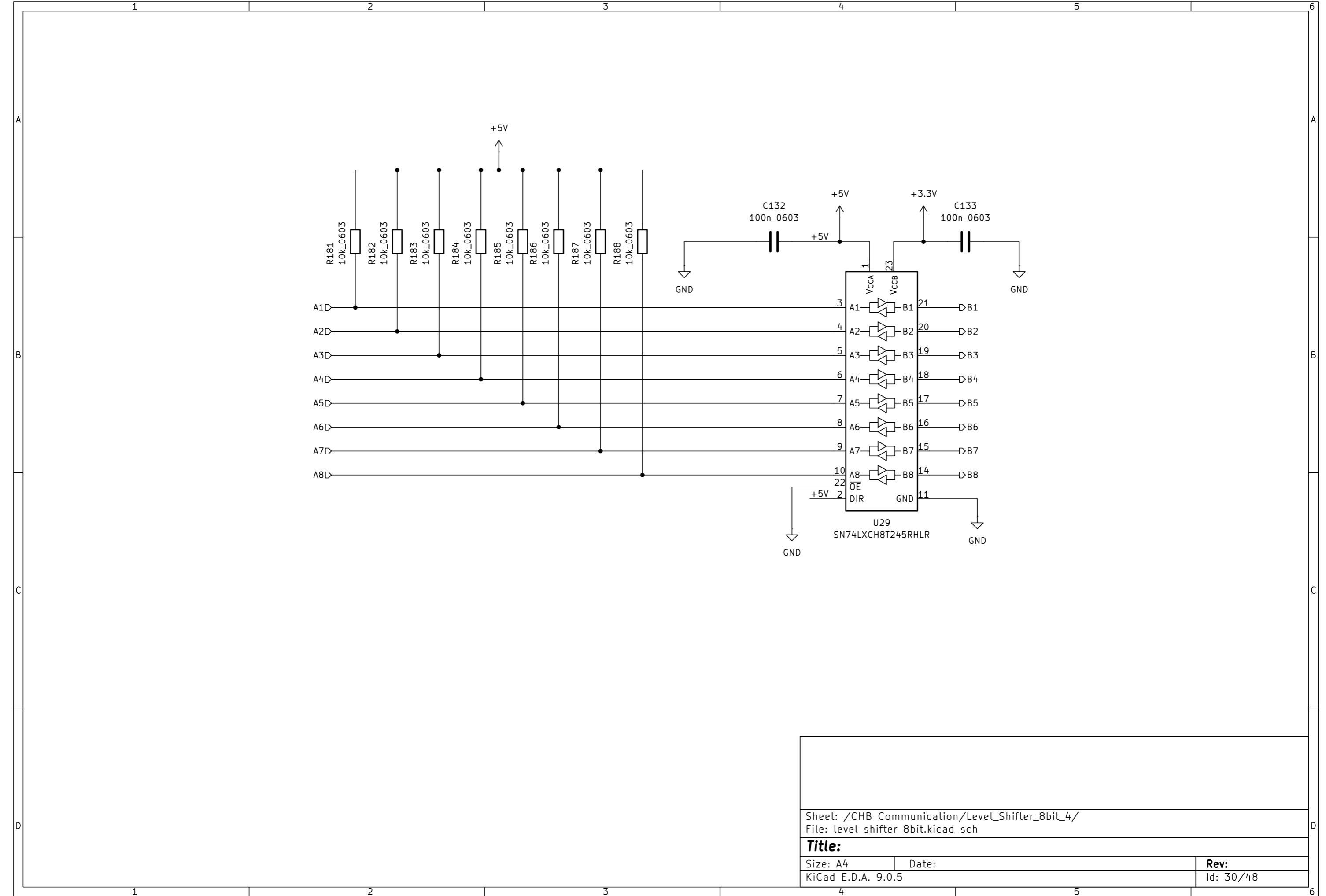
Title:

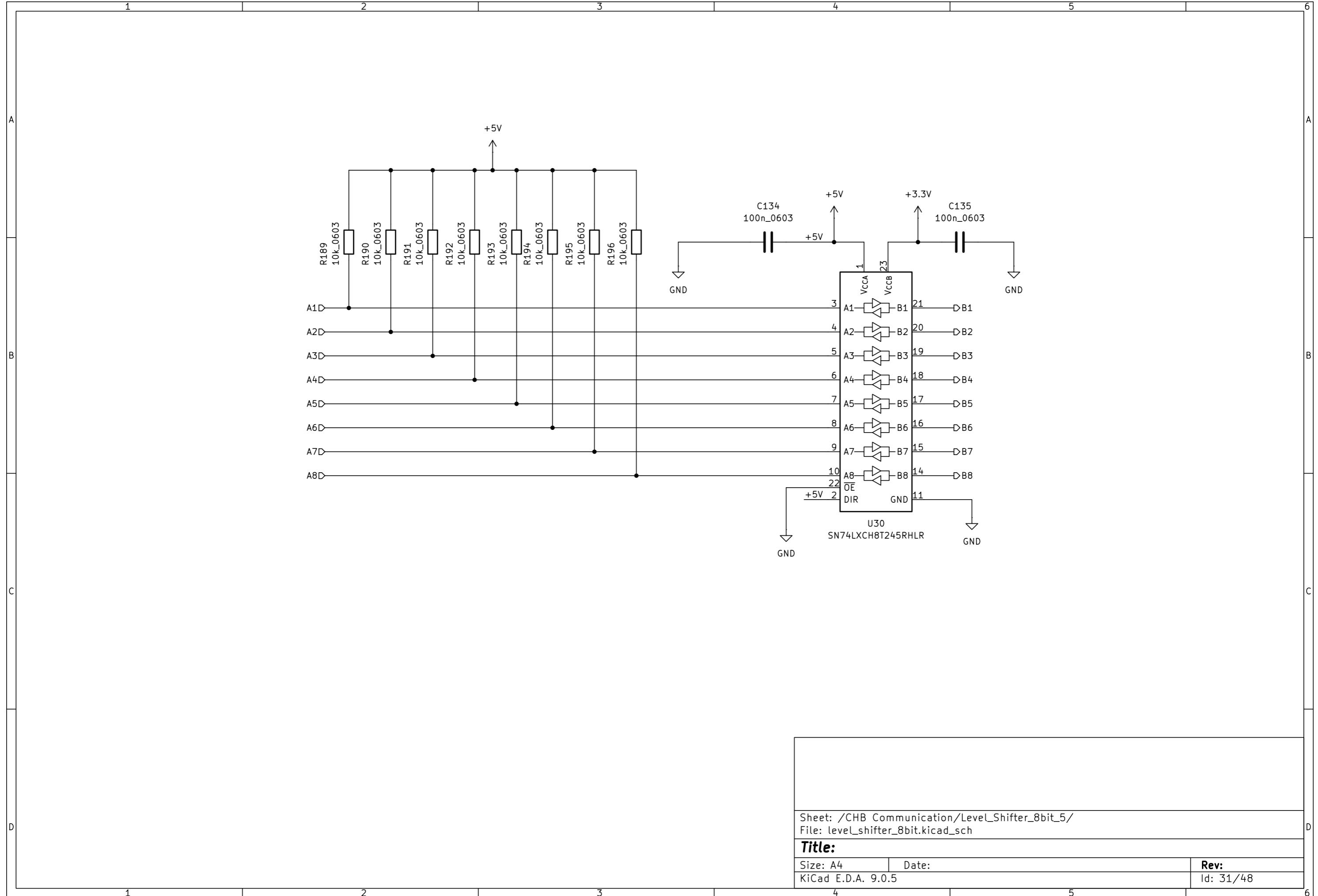
Size: A4 Date:
KiCad E.D.A. 9.0.5

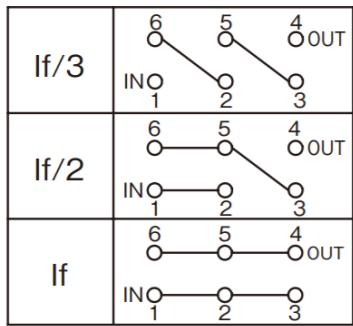
Rev:
Id: 25/48











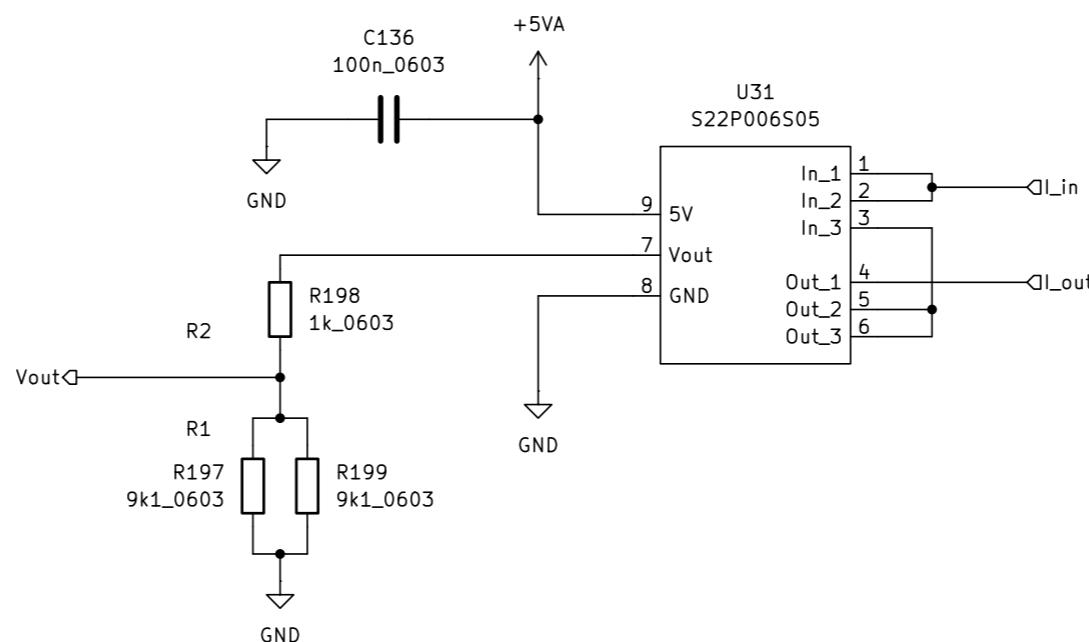
ADC Reference is 4.096V

$$\begin{aligned} V_{out} &= V * R_1 / (R_1 + R_2) \\ 4.096V &= 5V * R_1 / (R_1 + R_2) \\ 0.8192 &= R_1 / (R_1 + R_2) \\ 0.8192 * R_1 + 0.8192 * R_2 &= R_1 \\ 0.1808 * R_1 &= 0.8192 * R_2 \\ R_1 / R_2 &= 4.53097 \end{aligned}$$

$$\begin{aligned} R_1 &:= 9.1k \parallel 9.1k = 4.55k \\ R_2 &= 1k \\ R_1/R_2 &= 4.55 \end{aligned}$$

$$\begin{aligned} V_{out_max} &= 5V * 4.55 / 5.55 = 4.099V \\ \rightarrow \text{very little saturation} \end{aligned}$$

If for S22P006S05 is 6A



Sheet: /Current measure/Tamura_2/
File: tamura.kicad_sch

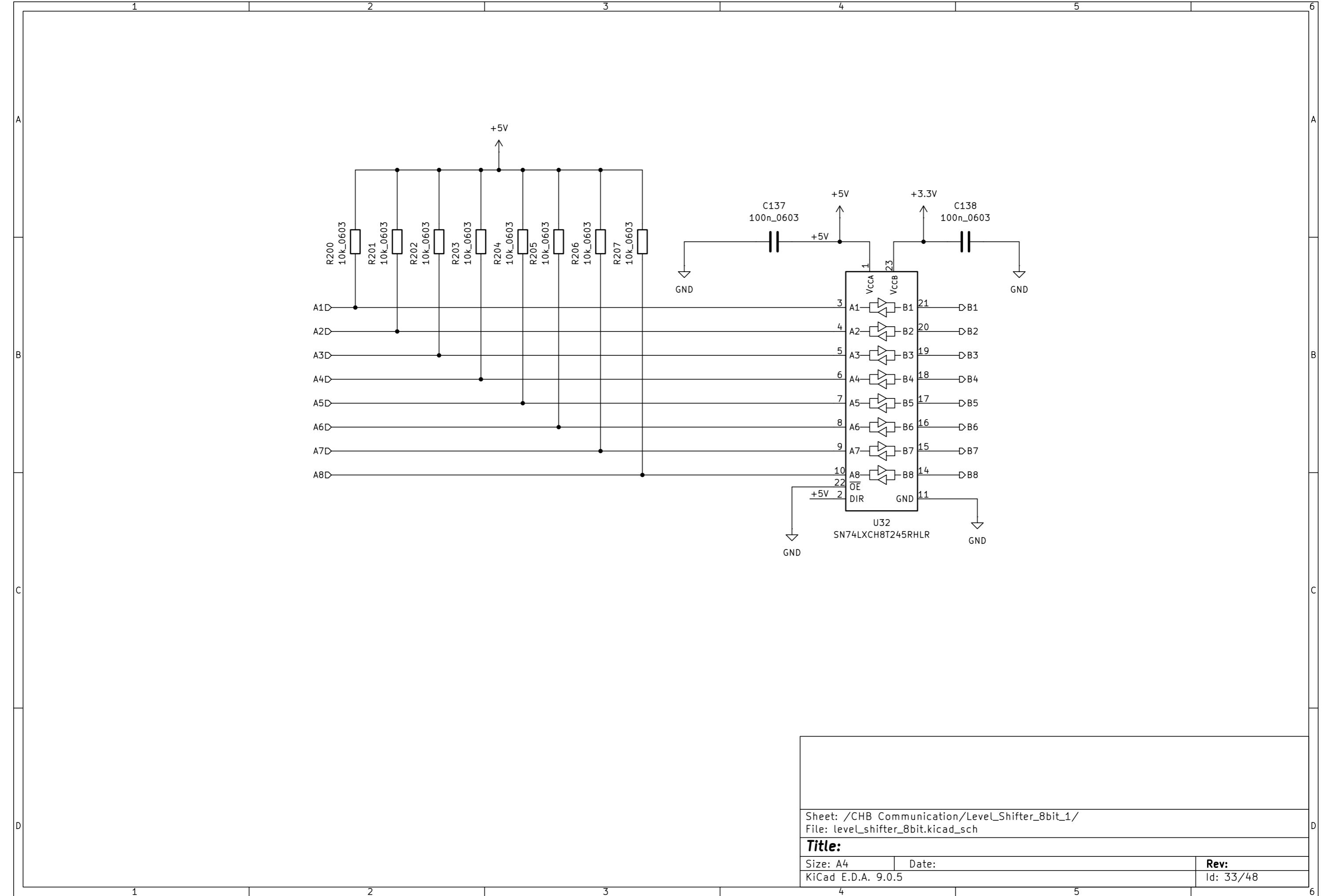
Title:

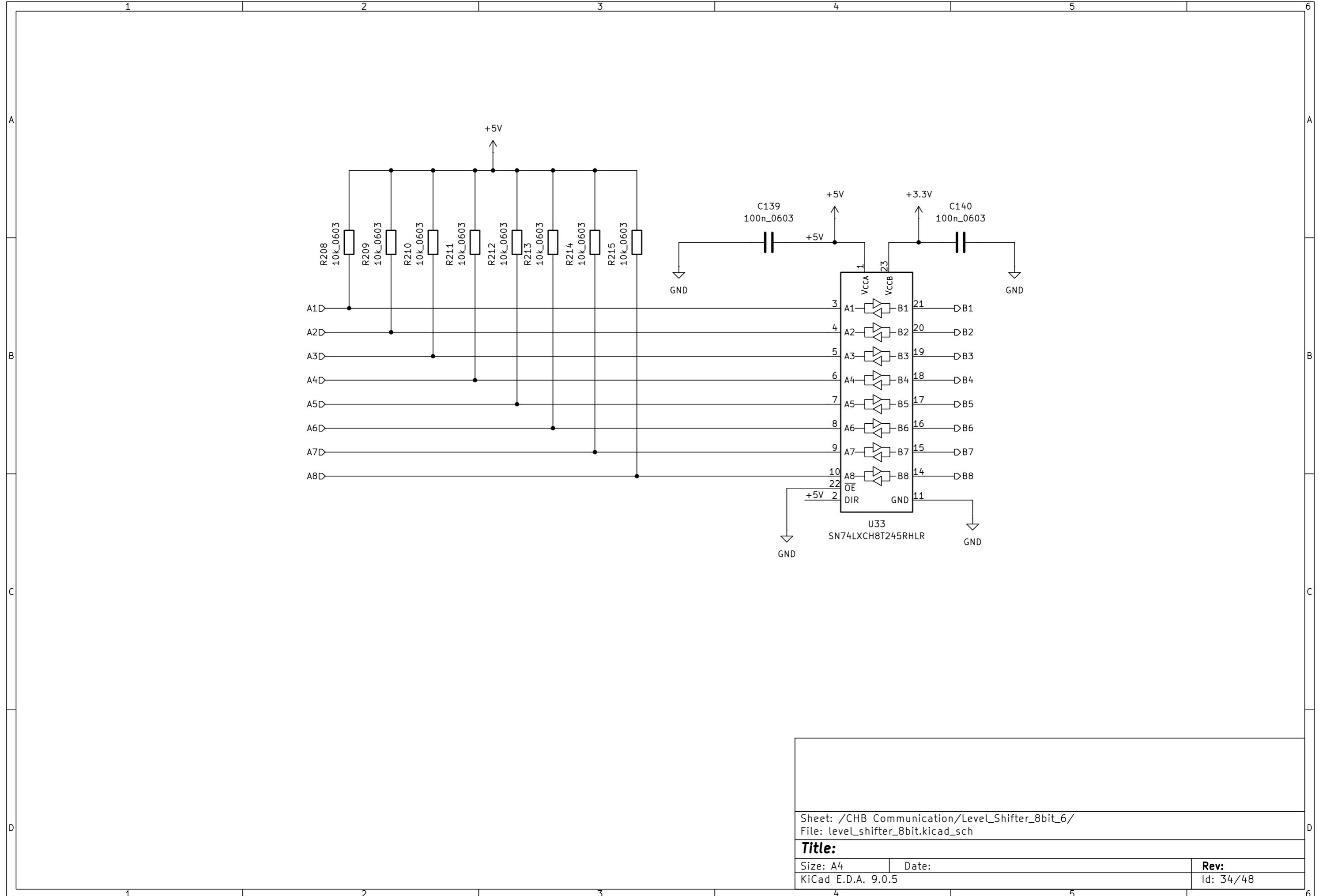
Size: A4 Date:

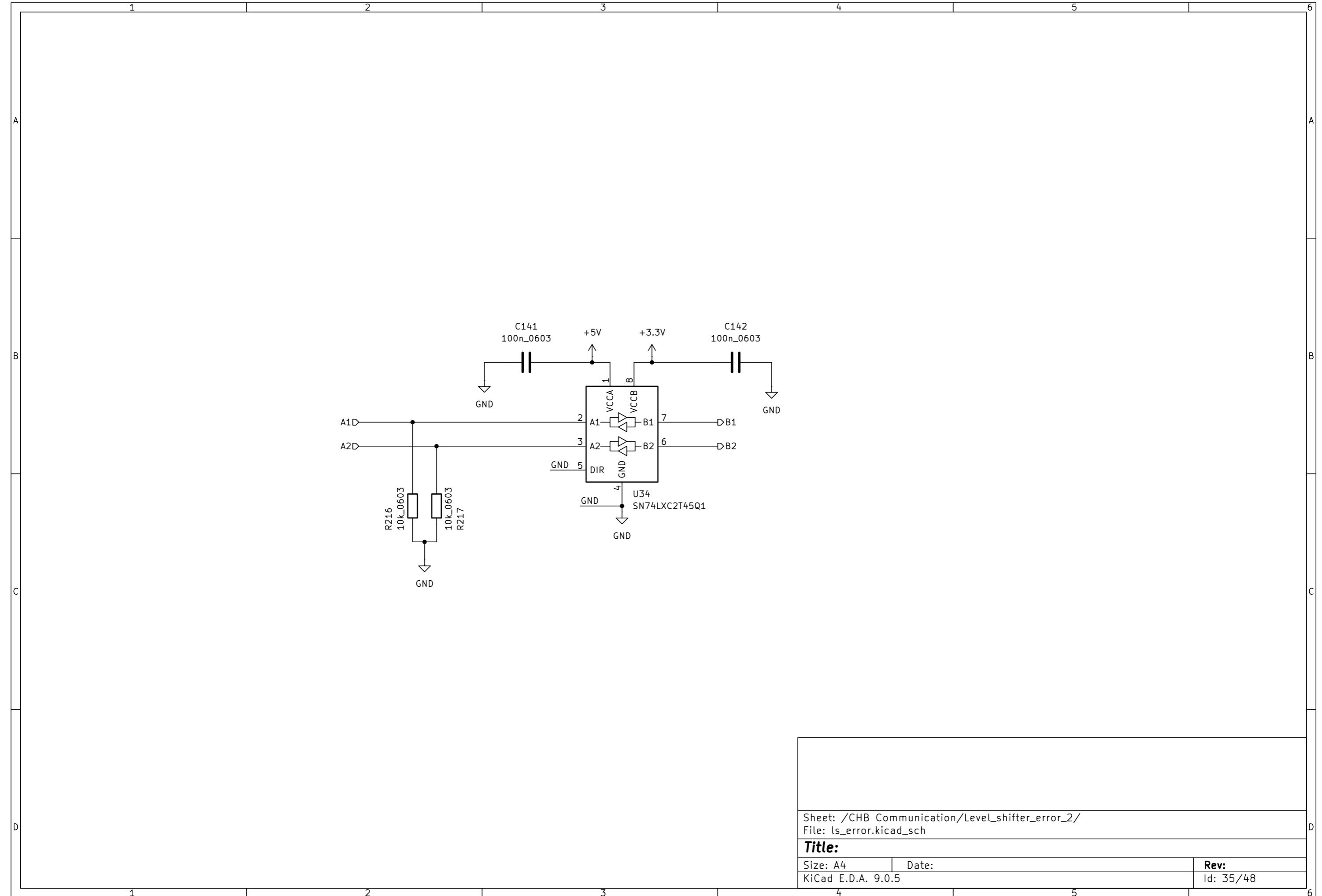
KiCad E.D.A. 9.0.5

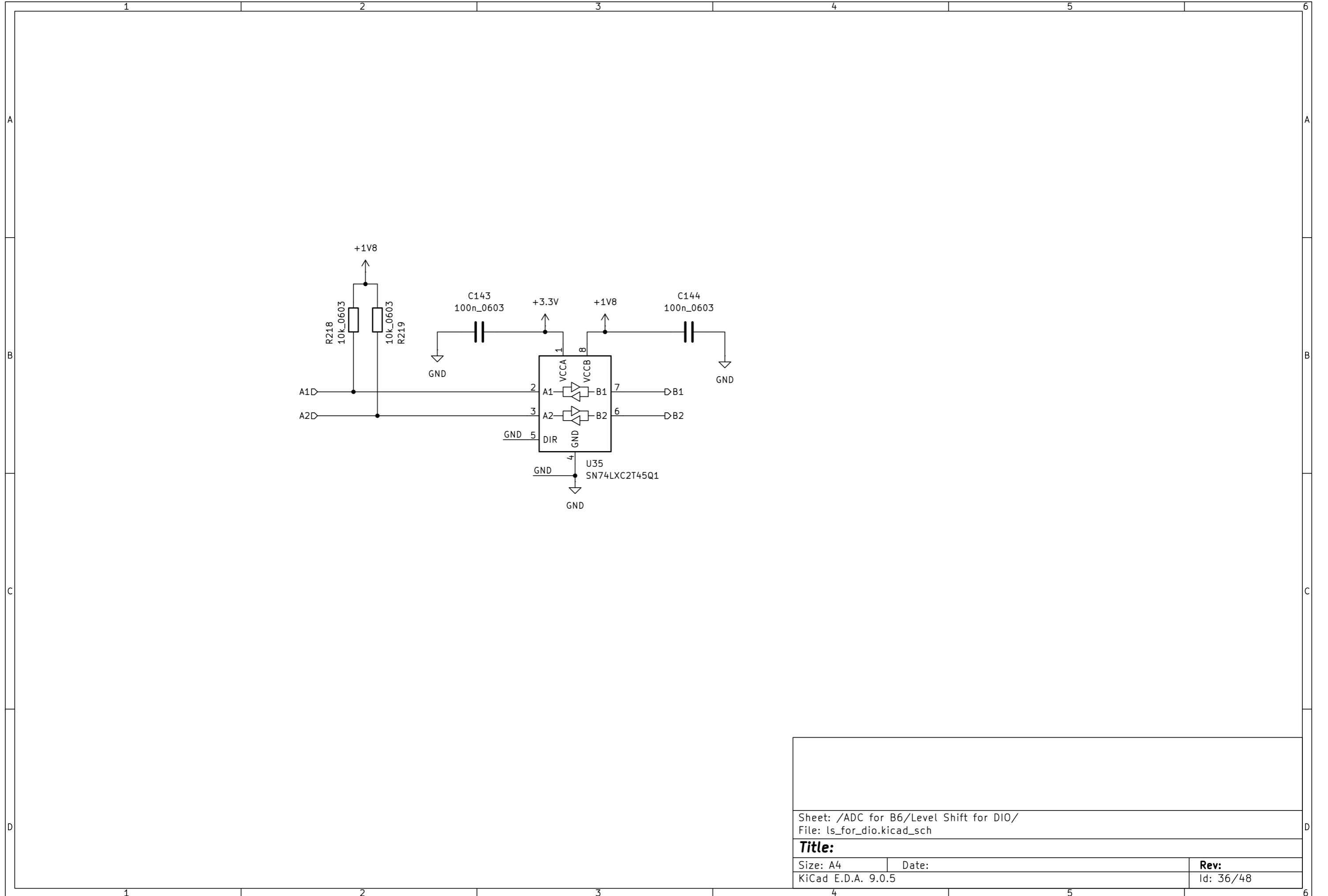
Rev:

Id: 32/48







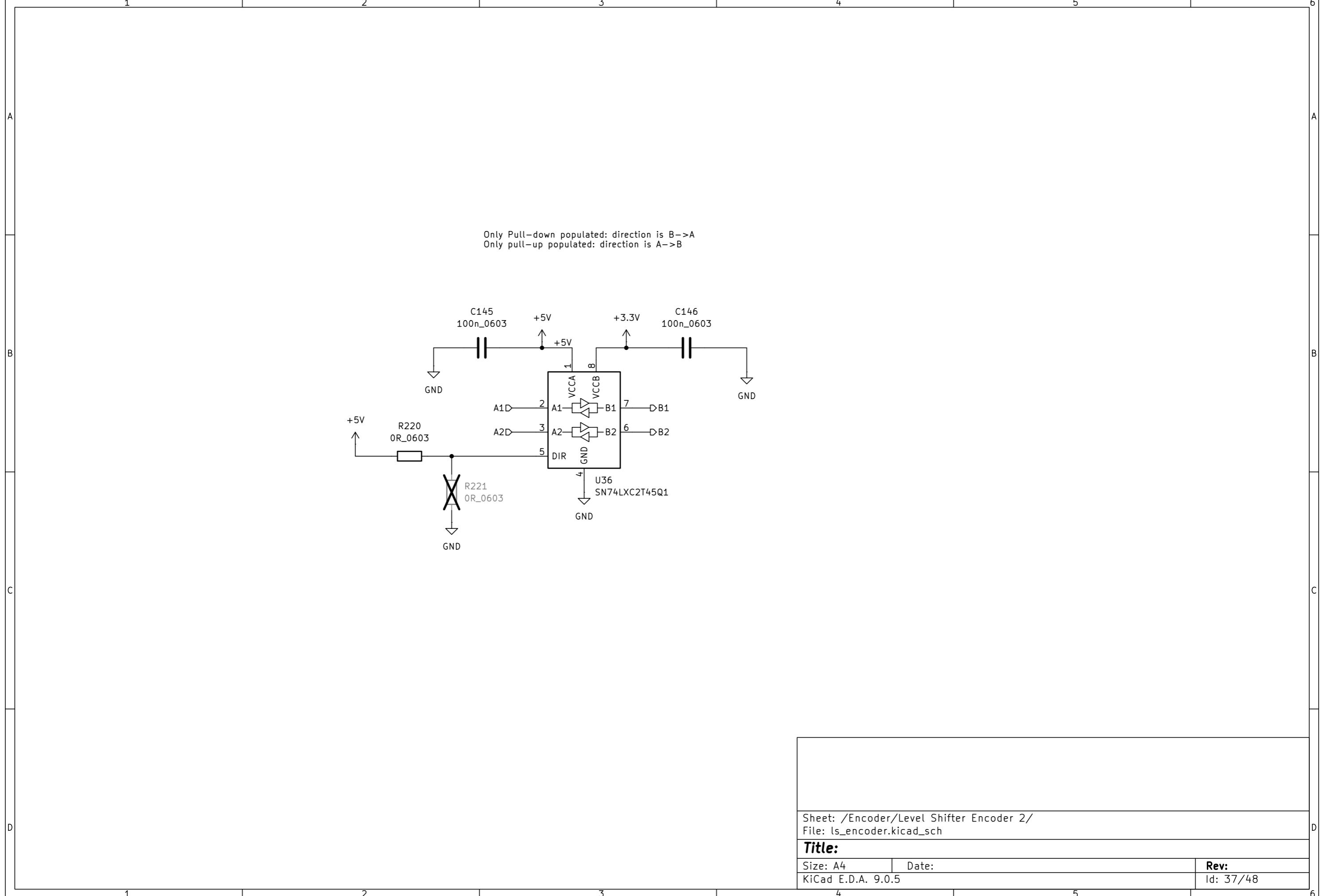


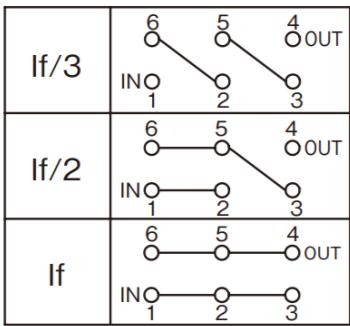
Sheet: /ADC for B6/Level Shift for DIO/
File: ls_for_dio.kicad_sch

Title:

Size: A4 Date:
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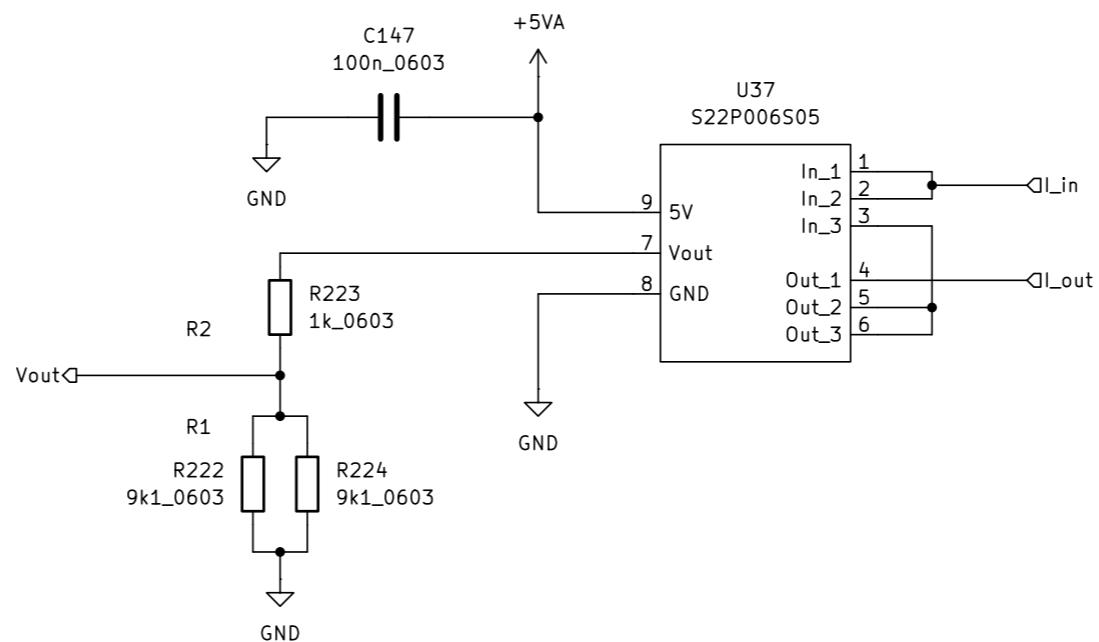
ADC Reference is 4.096V

$$\begin{aligned} V_{out} &= V * R_1 / (R_1 + R_2) \\ 4.096V &= 5V * R_1 / (R_1 + R_2) \\ 0.8192 &= R_1 / (R_1 + R_2) \\ 0.8192 * R_1 + 0.8192 * R_2 &= R_1 \\ 0.1808 * R_1 &= 0.8192 * R_2 \\ R_1 / R_2 &= 4.53097 \end{aligned}$$

$$\begin{aligned} R_1 &:= 9.1k \parallel 9.1k = 4.55k \\ R_2 &= 1k \\ R_1/R_2 &= 4.55 \end{aligned}$$

$$\begin{aligned} V_{out_max} &= 5V * 4.55 / 5.55 = 4.099V \\ \rightarrow \text{very little saturation} \end{aligned}$$

If for S22P006S05 is 6A



Sheet: /Current measure/Tamura_3/
File: tamura.kicad_sch

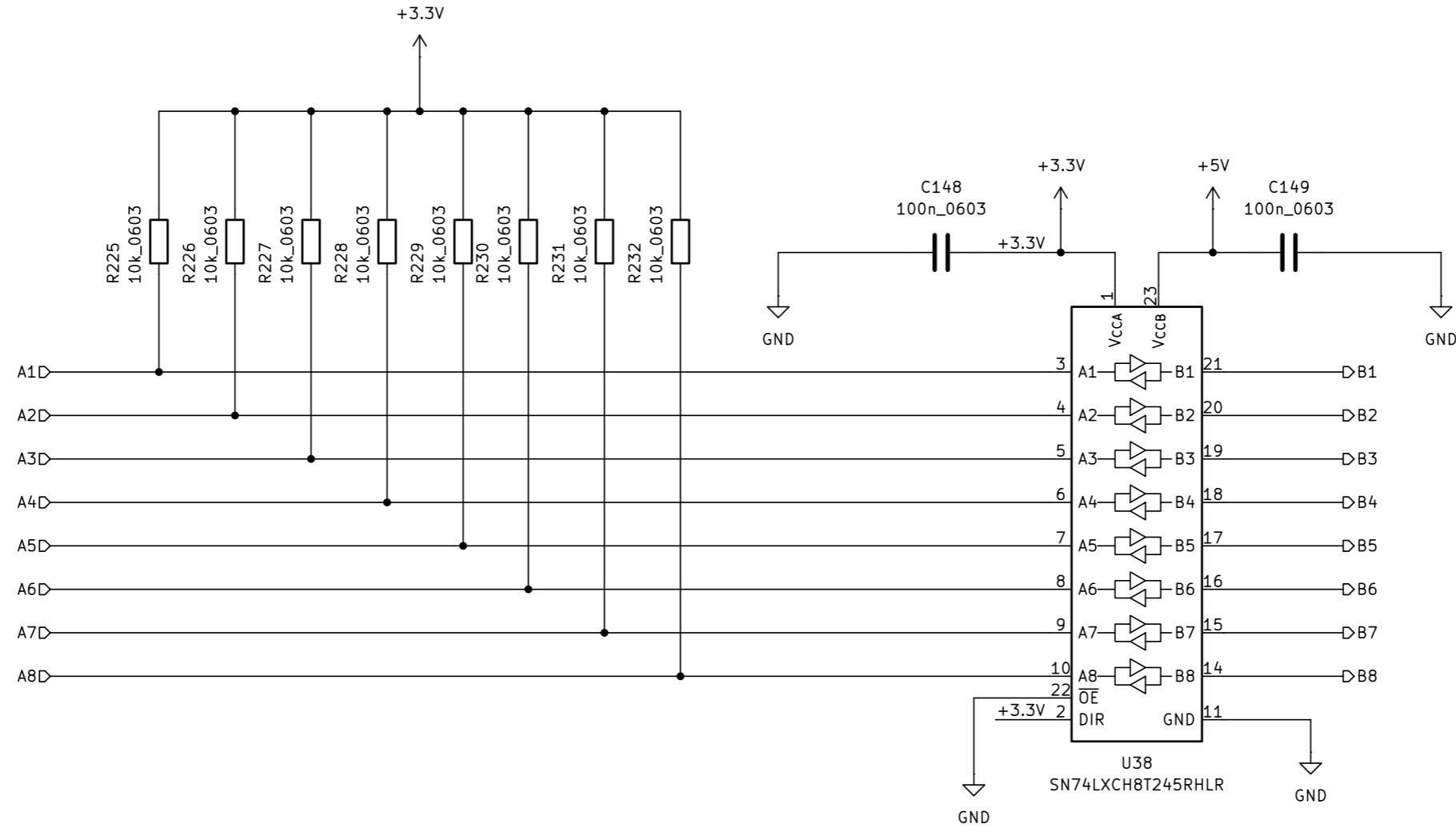
Title:

Size: A4 Date:

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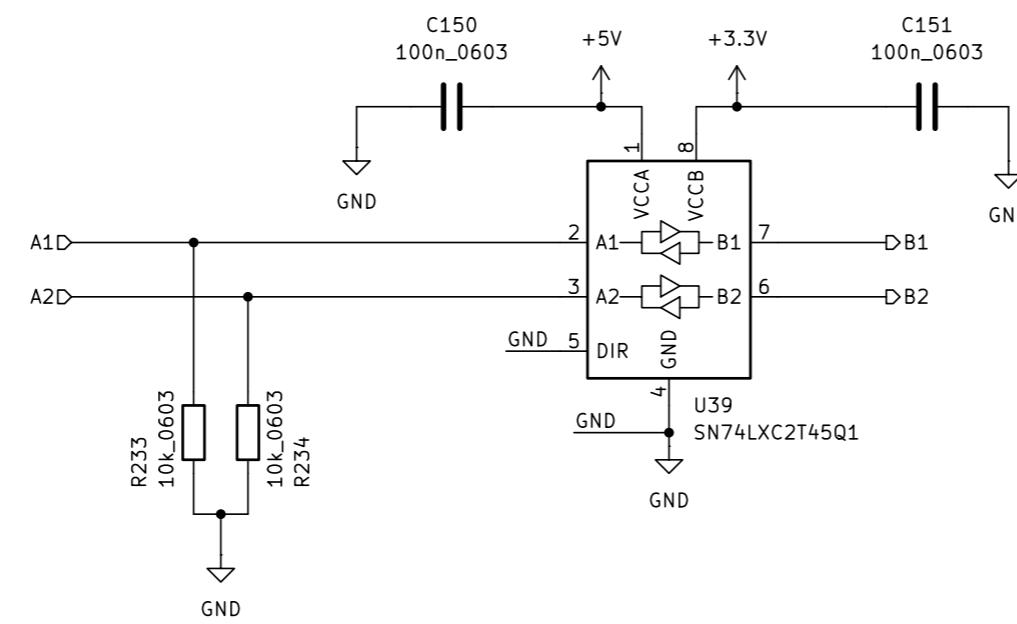


Sheet: /CHB Communication/Level_shifter_Rx_En/
File: ls_rx_en.kicad_sch

Title:

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

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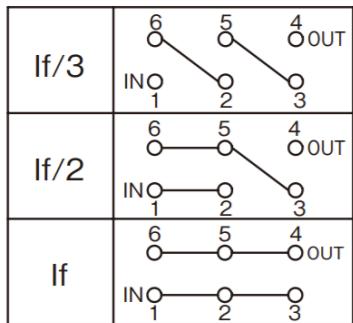


Sheet: /CHB_Communication/Level_shifter_error_1/
File: ls_error.kicad_sch

Title:

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

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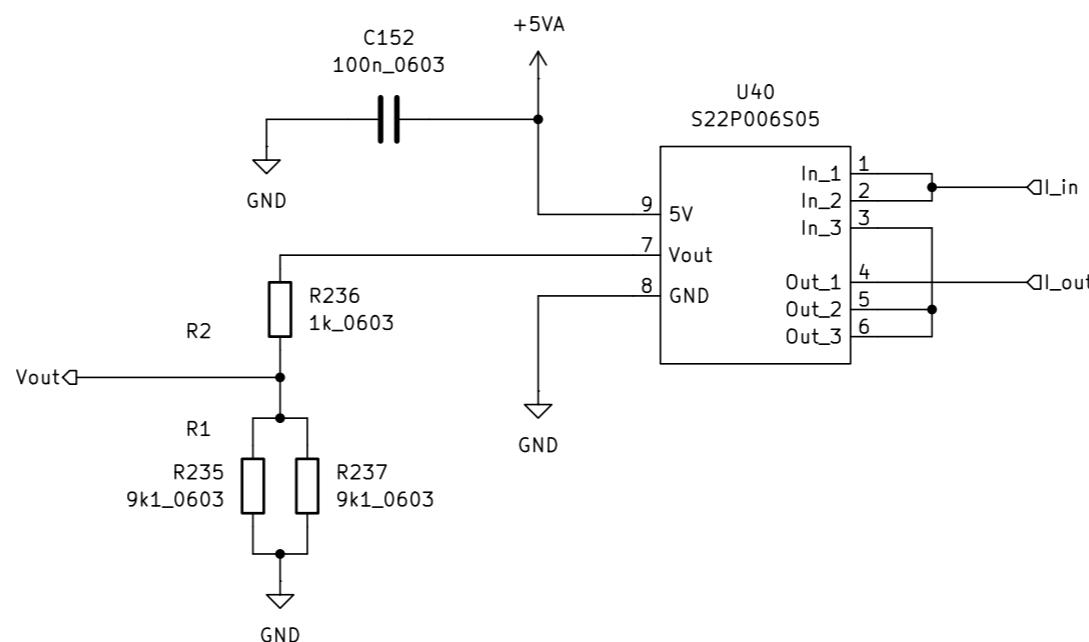
ADC Reference is 4.096V

$$\begin{aligned} V_{out} &= V * R_1 / (R_1 + R_2) \\ 4.096V &= 5V * R_1 / (R_1 + R_2) \\ 0.8192 &= R_1 / (R_1 + R_2) \\ 0.8192 * R_1 + 0.8192 * R_2 &= R_1 \\ 0.1808 * R_1 &= 0.8192 * R_2 \\ R_1 / R_2 &= 4.53097 \end{aligned}$$

$$\begin{aligned} R_1 &:= 9.1k \parallel 9.1k = 4.55k \\ R_2 &= 1k \\ R_1/R_2 &= 4.55 \end{aligned}$$

$$\begin{aligned} V_{out_max} &= 5V * 4.55 / 5.55 = 4.099V \\ \rightarrow \text{very little saturation} \end{aligned}$$

If for S22P006S05 is 6A



A

A

B

B

C

C

D

D

Sheet: /Current measure/Tamura_4/
File: tamura.kicad_sch

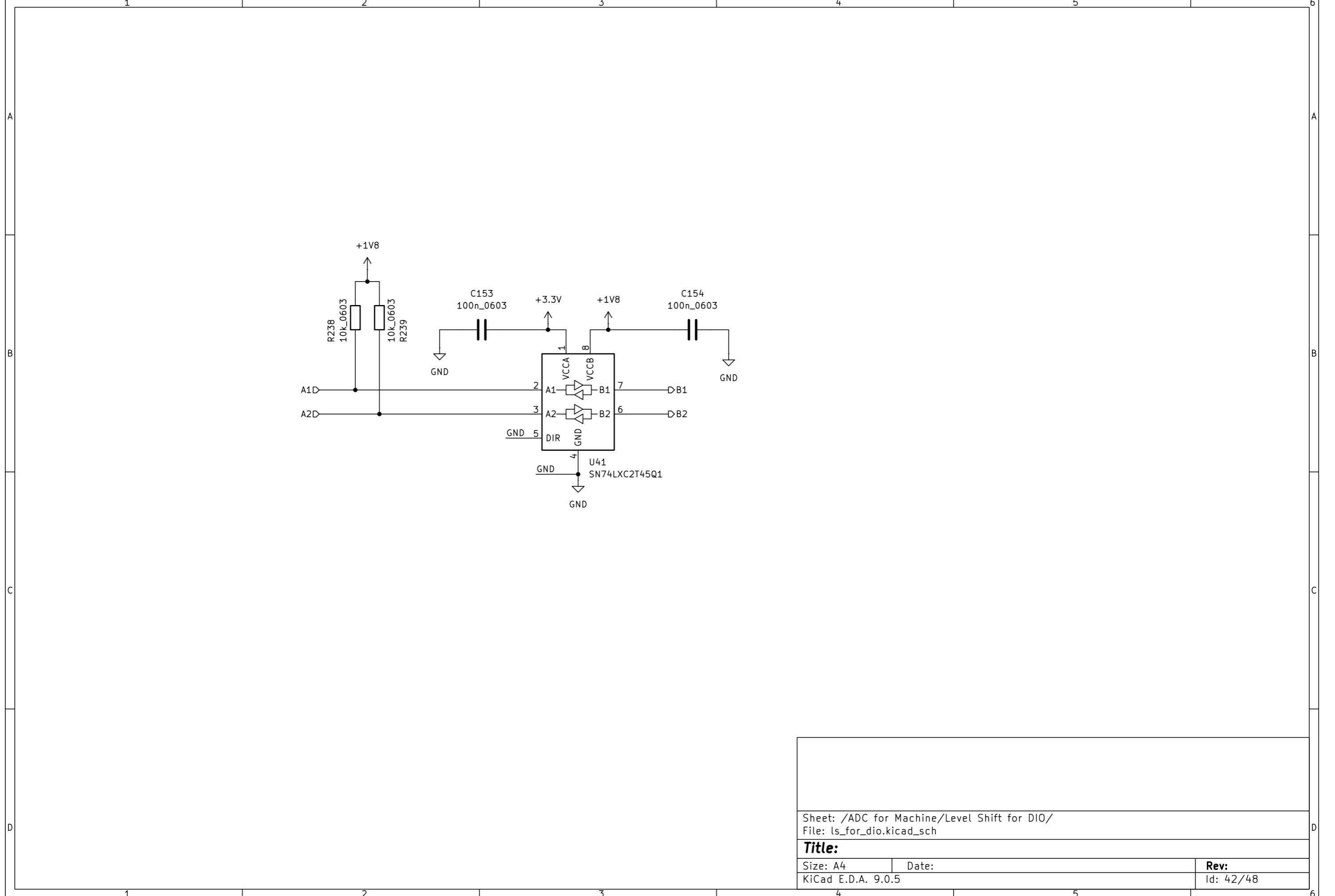
Title:

Size: A4 Date:

KiCad E.D.A. 9.0.5

Rev:

Id: 41/48

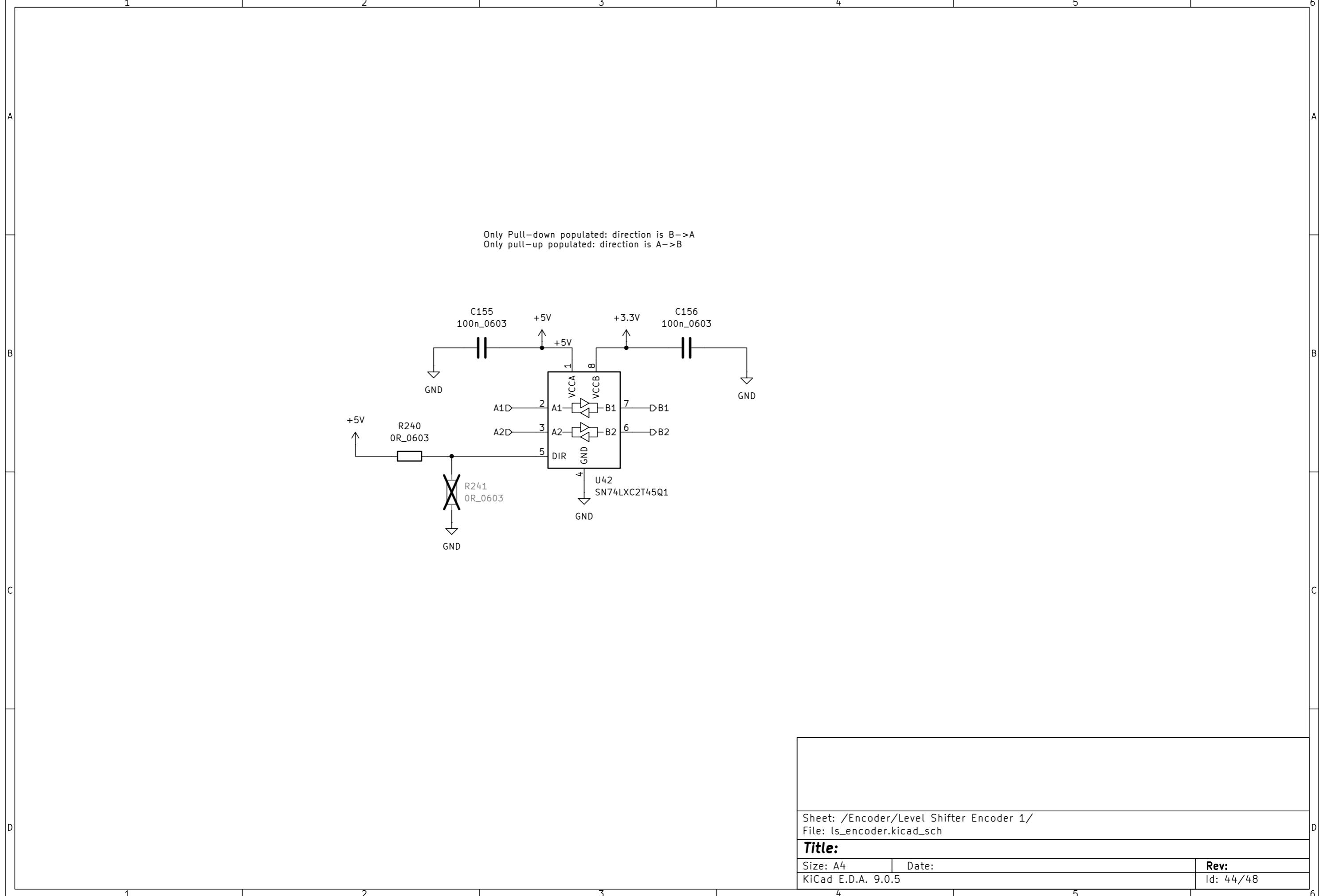


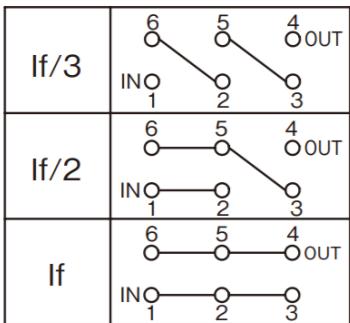
Sheet: /ADC for Machine/Level Shift for DIO/
File: ls_for_dio.kicad_sch

Title:

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

Rev:
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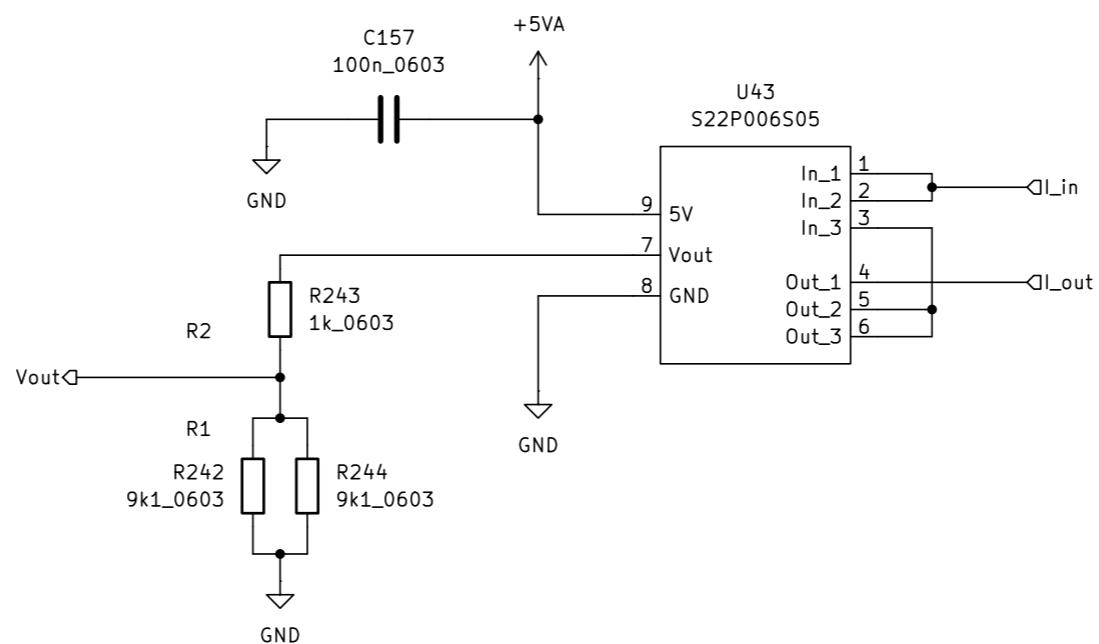
ADC Reference is 4.096V

$$\begin{aligned} V_{out} &= V * R_1 / (R_1 + R_2) \\ 4.096V &= 5V * R_1 / (R_1 + R_2) \\ 0.8192 &= R_1 / (R_1 + R_2) \\ 0.8192 * R_1 + 0.8192 * R_2 &= R_1 \\ 0.1808 * R_1 &= 0.8192 * R_2 \\ R_1 / R_2 &= 4.53097 \end{aligned}$$

$$\begin{aligned} R_1 &:= 9.1k \parallel 9.1k = 4.55k \\ R_2 &= 1k \\ R_1/R_2 &= 4.55 \end{aligned}$$

$$\begin{aligned} V_{out_max} &= 5V * 4.55 / 5.55 = 4.099V \\ \rightarrow \text{very little saturation} \end{aligned}$$

If for S22P006S05 is 6A



Sheet: /Current measure/Tamura_1/
File: tamura.kicad_sch

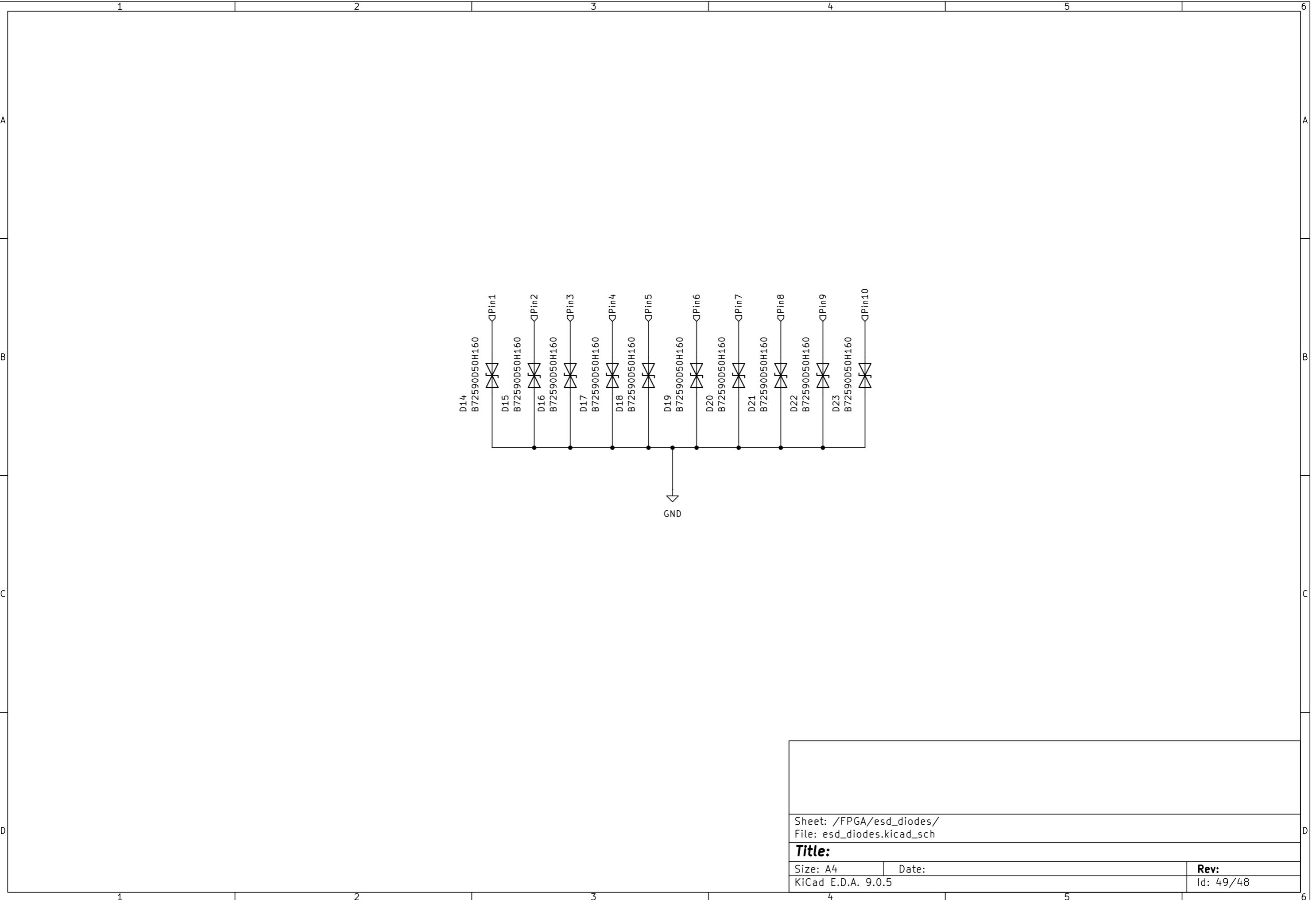
Title:

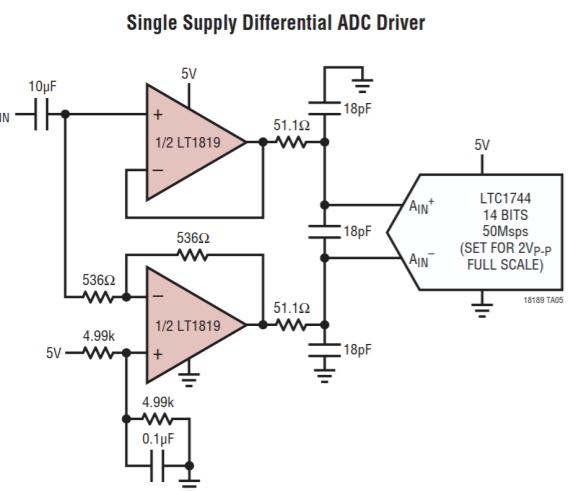
Size: A4 Date:

KiCad E.D.A. 9.0.5

Rev:

Id: 45/48



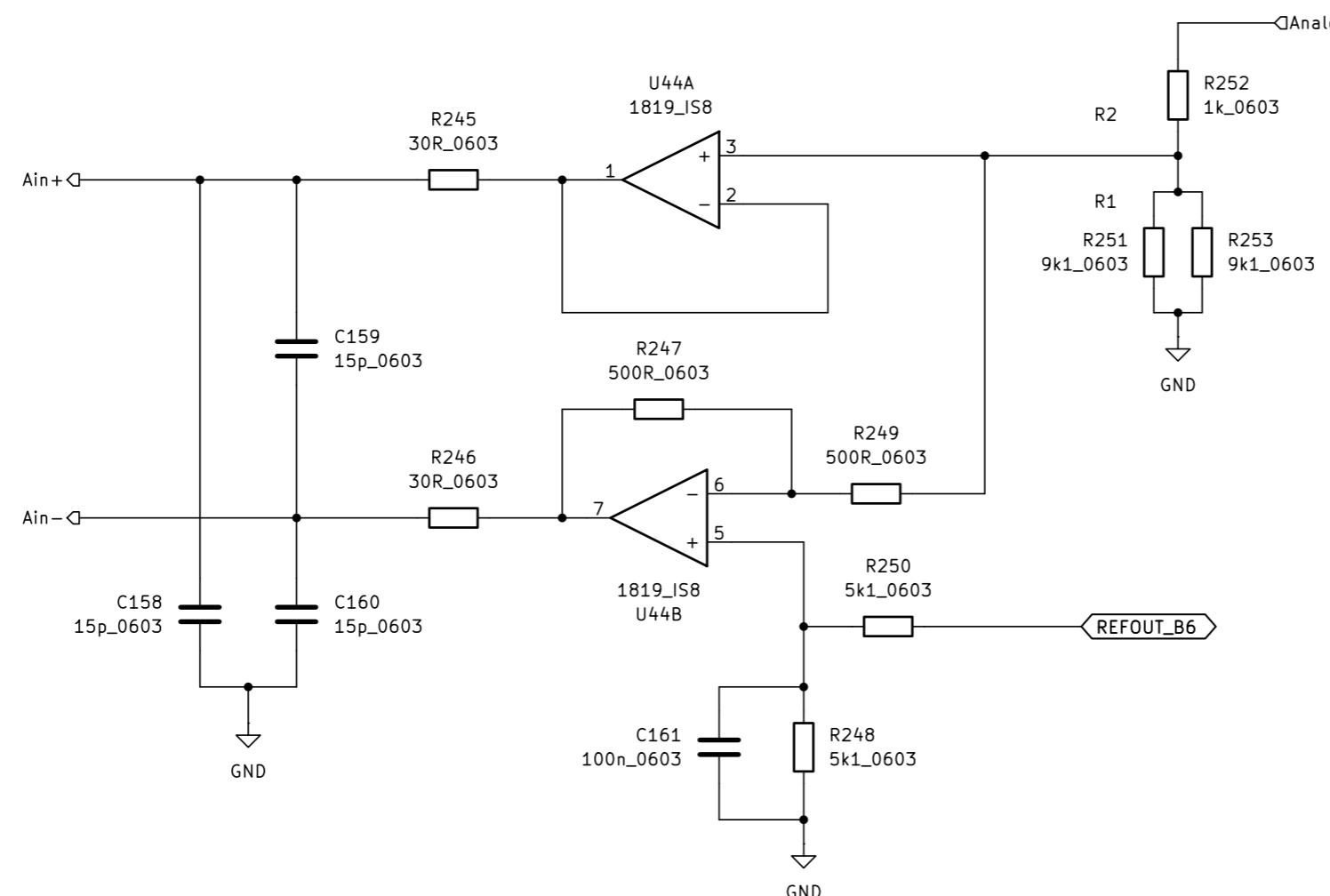
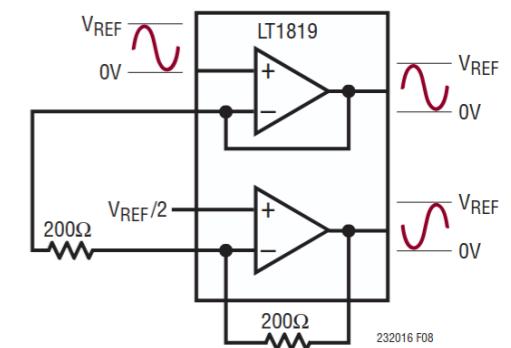


ADC Reference is 4.096V
 $V_{out} = V * R_1 / (R_1 + R_2)$
 $4.096V = 5V * R_1 / (R_1 + R_2)$
 $0.8192 = R_1 / (R_1 + R_2)$
 $0.8192 * R_1 + 0.8192 * R_2 = R_1$
 $0.1808 * R_1 = 0.8192 * R_2$
 $R_1 / R_2 = 4.53097$

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

$V_{out_max} = 5V * 4.55 / 5.55 = 4.099V$
 \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