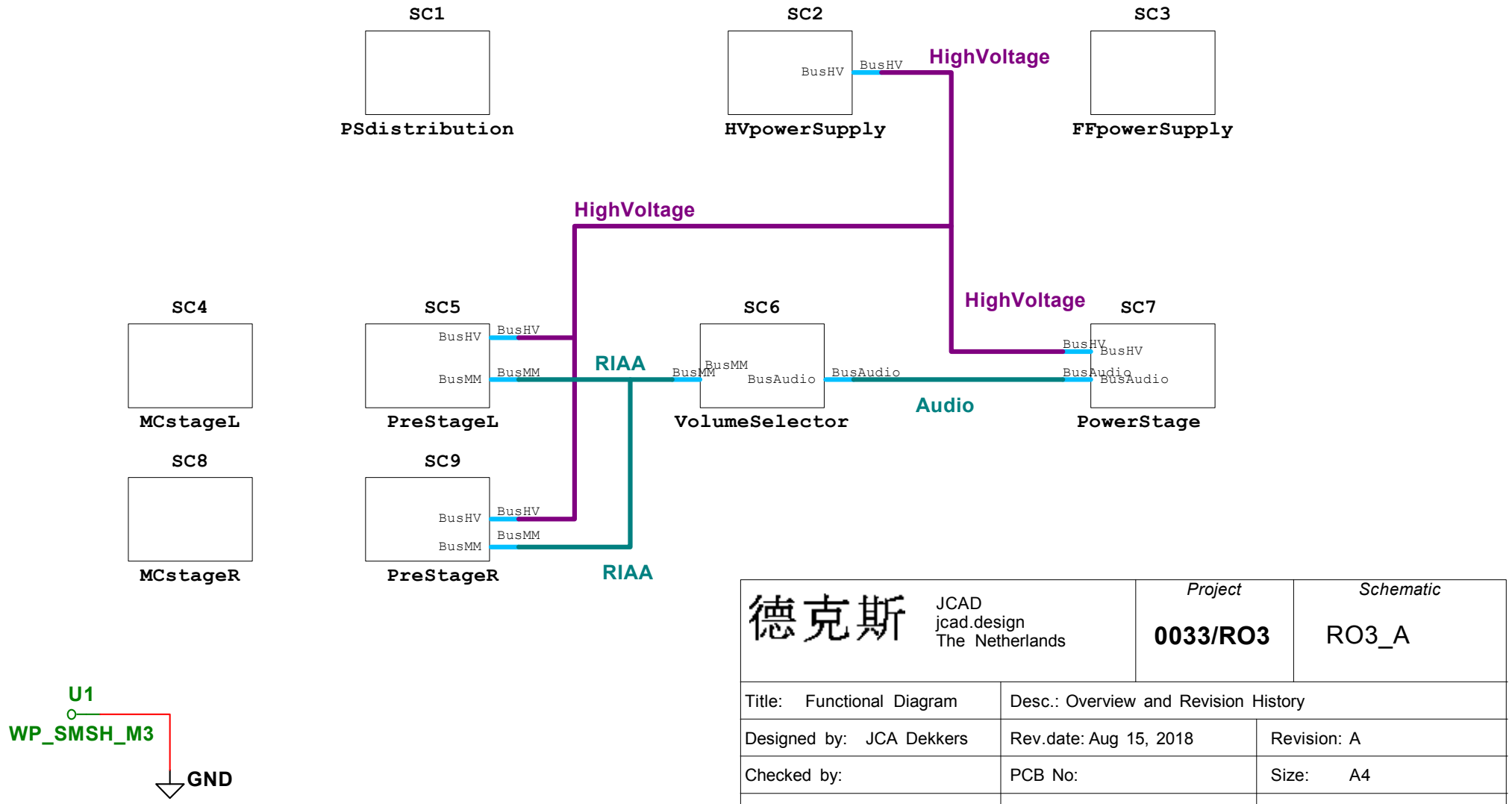
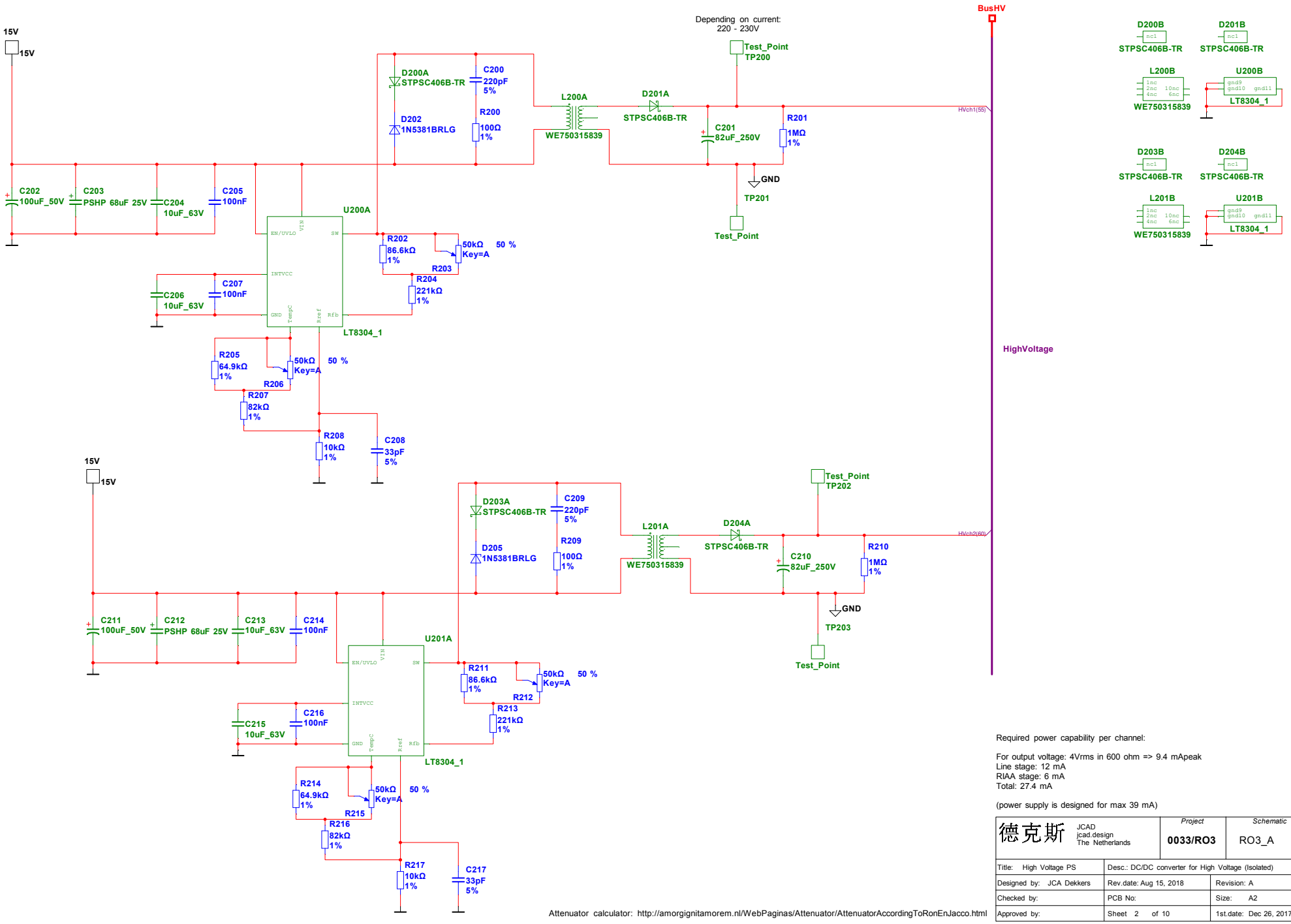
Revision History:
A Initial design

X1 MH X2 MH X3 MH X4 MH X5 MH X6 MH



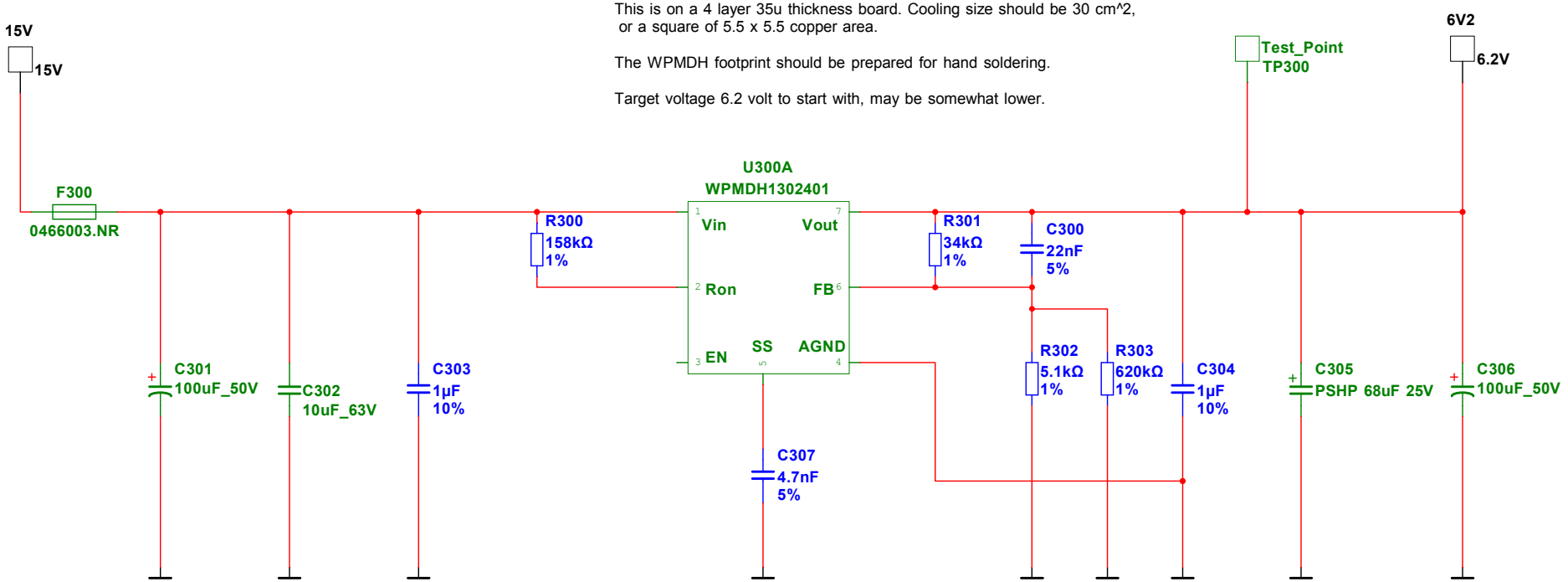
德克斯 JCAD jcad.design The Netherlands	*Project* 0033/RO3	*Schematic* RO3_A
Title: Functional Diagram	Desc.: Overview and Revision History	
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A
Checked by:	PCB No:	Size: A4
Approved by:	Sheet 1 of 10	1st.date: Nov 4, 2017


BusHV
Depending on current:
220 - 230V
15V
15V
D200A
STPSC406B-TR
C200
220pF
5%
D202
1N5381BRLG
R200
100Ω
1%
L200A
WE750315839
D201A
STPSC406B-TR
Test_Point
TP200
C201
82uF_250V
R201
1MΩ
1%
GND
TP201
Test_Point
HVch1(55)
C202
100uF_50V
C203
PSHP 68uF 25V
C204
10uF_63V
C205
100nF
U200A
EN/UVLO
VIN
SW
INTVCC
GND
TempC
Rref
Rfb
LT8304_1
R202
86.6kΩ
1%
50kΩ
Key=A
50 %
R203
R204
221kΩ
1%
C206
10uF_63V
C207
100nF
R205
64.9kΩ
1%
50kΩ
Key=A
50 %
R206
R207
82kΩ
1%
R208
10kΩ
1%
C208
33pF
5%
HighVoltage
D200B
STPSC406B-TR
D201B
STPSC406B-TR
L200B
WE750315839
U200B
LT8304_1
D203B
STPSC406B-TR
D204B
STPSC406B-TR
L201B
WE750315839
U201B
LT8304_1
15V
15V
D203A
STPSC406B-TR
C209
220pF
5%
D205
1N5381BRLG
R209
100Ω
1%
L201A
WE750315839
D204A
STPSC406B-TR
Test_Point
TP202
C210
82uF_250V
R210
1MΩ
1%
GND
TP203
Test_Point
HVch2(60)
C211
100uF_50V
C212
PSHP 68uF 25V
C213
10uF_63V
C214
100nF
U201A
EN/UVLO
VIN
SW
INTVCC
GND
TempC
Rref
Rfb
LT8304_1
R211
86.6kΩ
1%
50kΩ
Key=A
50 %
R212
R213
221kΩ
1%
C215
10uF_63V
C216
100nF
R214
64.9kΩ
1%
50kΩ
Key=A
50 %
R215
R216
82kΩ
1%
R217
10kΩ
1%
C217
33pF
5%
Attenuator calculator: http://amorgignitamorem.nl/WebPaginas/Attenuator/AttenuatorAccordingToRonEnJacco.html
Required power capability per channel:
For output voltage: 4Vrms in 600 ohm => 9.4 mApeak
Line stage: 12 mA
RIAA stage: 6 mA
Total: 27.4 mA
(power supply is designed for max 39 mA)
德克斯
JCAD
jcad.design
The Netherlands
Project
0033/RO3
Schematic
RO3_A
Title: High Voltage PS
Desc.: DC/DC converter for High Voltage (Isolated)
Designed by: JCA Dekkers
Rev.date: Aug 15, 2018
Revision: A
Checked by:
PCB No:
Size: A2
Approved by:
Sheet 2 of 10
1st.date: Dec 26, 2017

For 2.5 A ampere one needs 22 K/W thermal resisantce (see datasheet).
This is on a 4 layer 35u thickness board. Cooling size should be 30 cm^2,
or a square of 5.5 x 5.5 copper area.

The WPMDH footprint should be prepared for hand soldering.

Target voltage 6.2 volt to start with, may be somewhat lower.



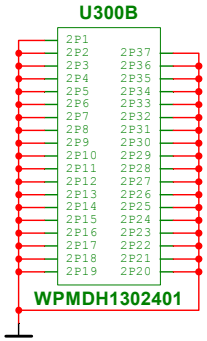
AGND should be connected
to 1uF Cout as short as possible.

Design procedure:
1a. Rfbt/Rfbb = (Vout/0.803) - 1 = 6.72...
1b. Resistors should be between 1k ... 50k
1c. Choose Rfbt = 34k => Rfbb = 5.059 k

2a. Fsw(ccm) should be between 200kHz...800kHz, target 300kHz
2b. Ron = Vout/(1.3e-10 * Fsw(ccm)) => 158k
2c. Check whether Ron equal or greater than Vinmax*150e-9/1.3e-10 => okay!

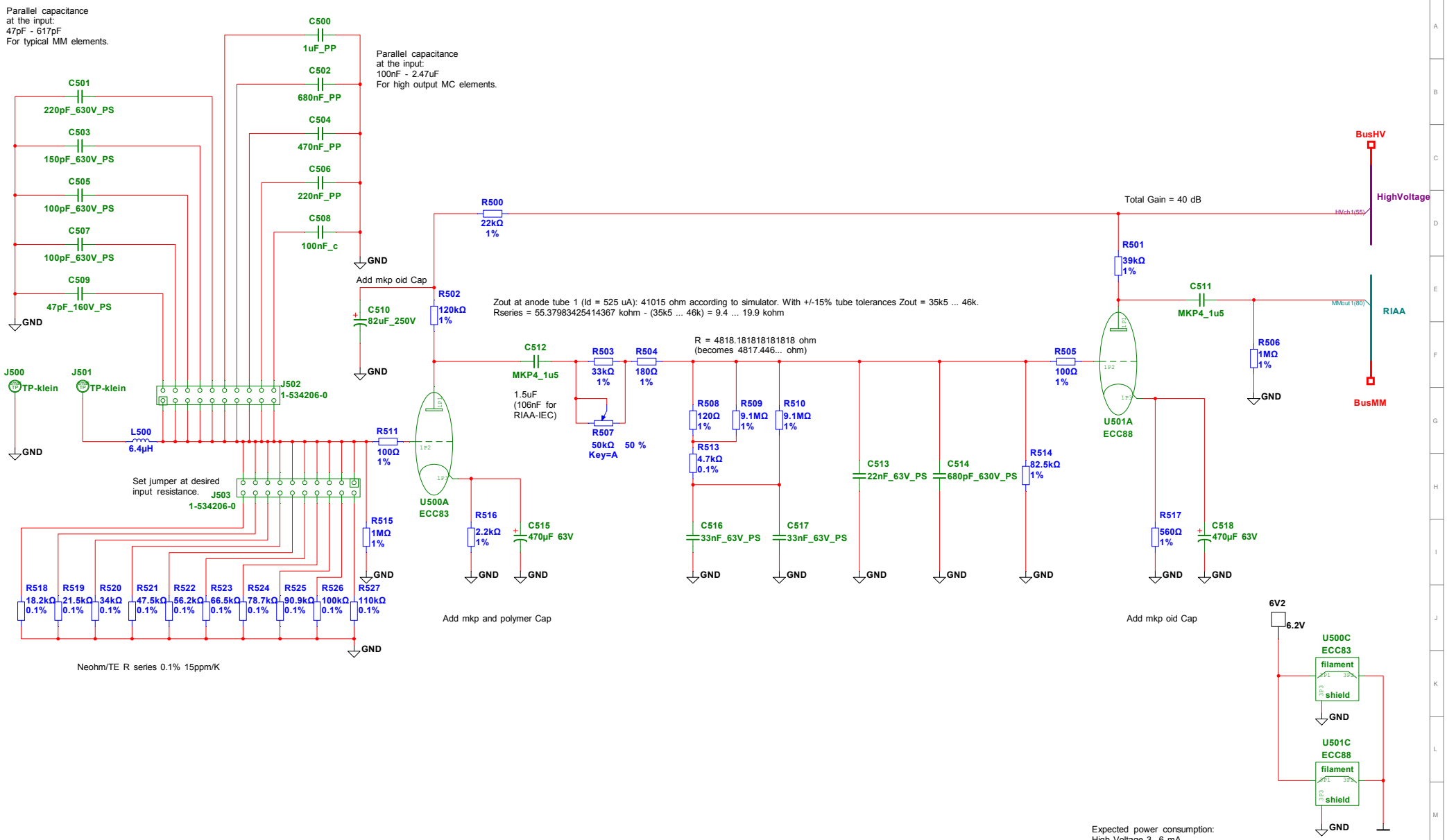
With Vin = 15, Vout = 6.2 and Fsw = 300k the DCM/CCM boundary is at approx 600 mA.

3a. Worst case input ripple current 0.5*Iout*sqrt(D/(1-D)) => 1.18 A. Input C should be able to withstand this.
3b. Value of Cin is related to the maximum DeltaVin: Cin equal or greater than Iout*D*(1-D)/(Fsw(ccm)*DeltaVin) => 100uF safe choice



Required power capability:
Filament: 6.3V at 2 x 1.095...1425 mA = 2.19...2.85 A

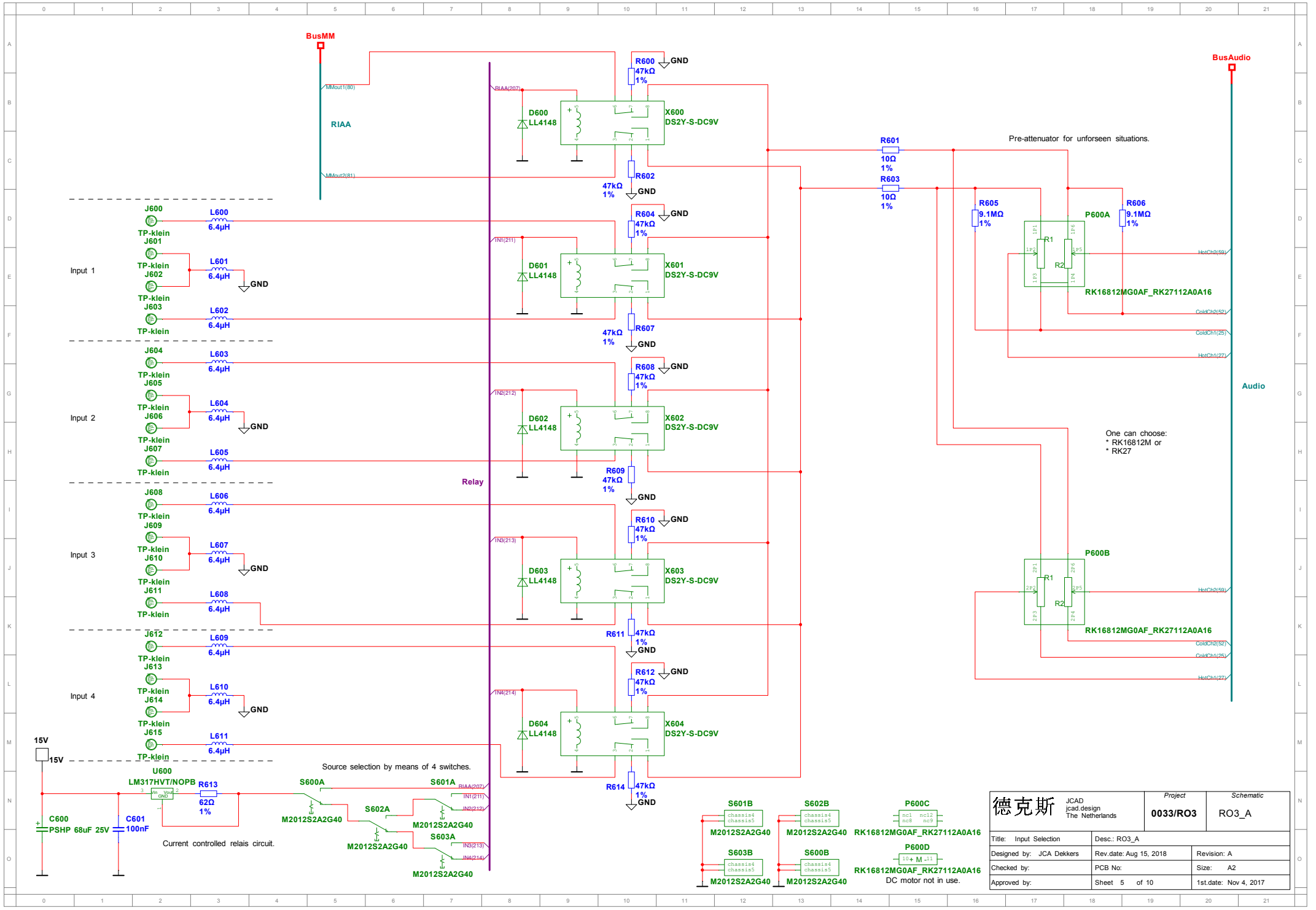
德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: Filament PS	Desc.: DC/DC power supply for filaments		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A3	
Approved by:	Sheet 3 of 10	1st.date: Dec 24, 2017	

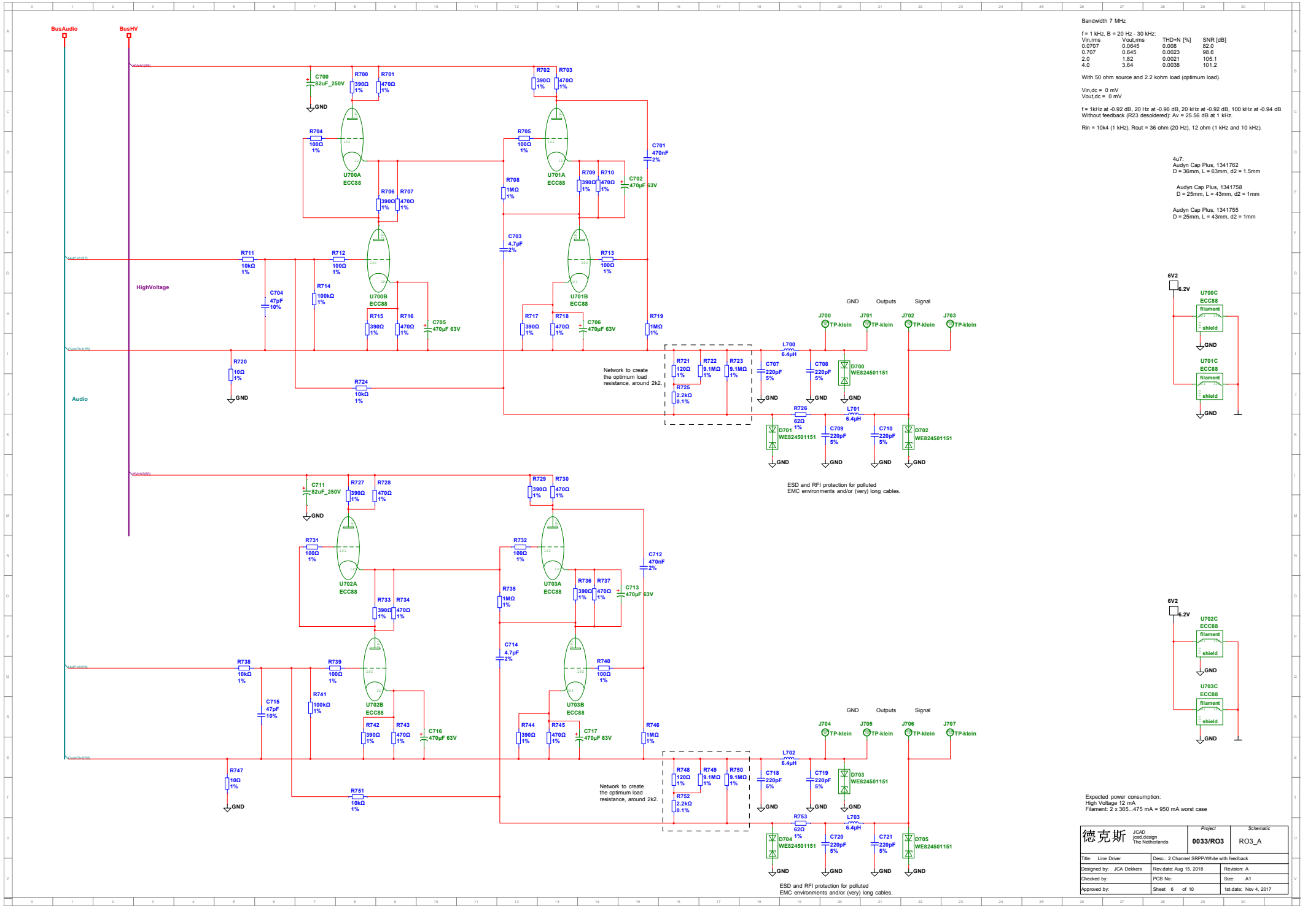


Capacitors: LCR Components FSC(/EX) series
Resistors: TE Connectivity/Neohm H8 (Holco), R series
Welwyn RC, RC55, PR (low cost) series
Vishay Dale PTF series
http://nl.farnell.com/webapp/wcs/stores/servlet/Search?catalogId=15001&langId=31&storeId=10168&categoryId=700000005447&pageSize=25&showResults=true&sf=432,502,721&pf=110003727,110075262,110101775,110124724,112067013

Passive RIAA calculator: http://amorgignitamorem.nl/WebPaginas/passieve_RIAA/passieve_RIAA.html

德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: MM RIAA stage (left)	Desc.: Passive RIAA and Input Impedance Selection		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A2	
Approved by:	Sheet 4 of 10	1st.date: Nov 4, 2017	


BusMM
MMout1(80)
RIAA
MMout2(81)
RIAA(207)
IN1(211)
IN2(212)
IN3(213)
IN4(214)
D600 LL4148
D601 LL4148
D602 LL4148
D603 LL4148
D604 LL4148
X600 DS2Y-S-DC9V
X601 DS2Y-S-DC9V
X602 DS2Y-S-DC9V
X603 DS2Y-S-DC9V
X604 DS2Y-S-DC9V
R600 47kΩ 1%
R602 47kΩ 1%
R604 47kΩ 1%
R607 47kΩ 1%
R608 47kΩ 1%
R609 47kΩ 1%
R610 47kΩ 1%
R611 47kΩ 1%
R612 47kΩ 1%
R614 47kΩ 1%
GND
Relay
R601 10Ω 1%
R603 10Ω 1%
Pre-attenuator for unforseen situations.
R605 9.1MΩ 1%
R606 9.1MΩ 1%
P600A
R1
R2
RK16812MG0AF_RK27112A0A16
HotCh2(59)
ColdCh2(52)
ColdCh1(25)
HotCh1(27)
BusAudio
Audio
One can choose:
* RK16812M or
* RK27
P600B
Input 1
Input 2
Input 3
Input 4
J600 TP-klein
J601 TP-klein
J602 TP-klein
J603 TP-klein
J604 TP-klein
J605 TP-klein
J606 TP-klein
J607 TP-klein
J608 TP-klein
J609 TP-klein
J610 TP-klein
J611 TP-klein
J612 TP-klein
J613 TP-klein
J614 TP-klein
J615 TP-klein
L600 6.4µH
L601 6.4µH
L602 6.4µH
L603 6.4µH
L604 6.4µH
L605 6.4µH
L606 6.4µH
L607 6.4µH
L608 6.4µH
L609 6.4µH
L610 6.4µH
L611 6.4µH
15V
U600 LM317HVT/NOPB
R613 62Ω 1%
C600 PSHP 68uF 25V
C601 100nF
Current controlled relais circuit.
Source selection by means of 4 switches.
S600A
S601A
S602A
S603A
M2012S2A2G40
S601B
S602B
S603B
S600B
P600C
P600D
RK16812MG0AF_RK27112A0A16
DC motor not in use.
德克斯
JCAD
jcad.design
The Netherlands
Project
0033/RO3
Schematic
RO3_A
Title: Input Selection
Desc.: RO3_A
Designed by: JCA Dekkers
Rev.date: Aug 15, 2018
Revision: A
Checked by:
PCB No:
Size: A2
Approved by:
Sheet 5 of 10
1st.date: Nov 4, 2017



Bandwidth 7 MHz

f = 1 kHz, B = 20 Hz - 30 kHz:

Vin,rms	Vout,rms	THD+N [%]	SNR [dB]
0.0707	0.0645	0.008	82.0
0.707	0.645	0.0023	98.6
2.0	1.82	0.0021	105.1
4.0	3.64	0.0038	101.2

With 50 ohm source and 2.2 kohm load (optimum load).

Vin,dc = 0 mV
Vout,dc = 0 mV

f = 1kHz at -0.92 dB, 20 Hz at -0.96 dB, 20 kHz at -0.92 dB, 100 kHz at -0.94 dB
Without feedback (R23 desoldered): Av = 25.56 dB at 1 kHz.

Rin = 10k4 (1 kHz), Rout = 36 ohm (20 Hz), 12 ohm (1 kHz and 10 kHz).

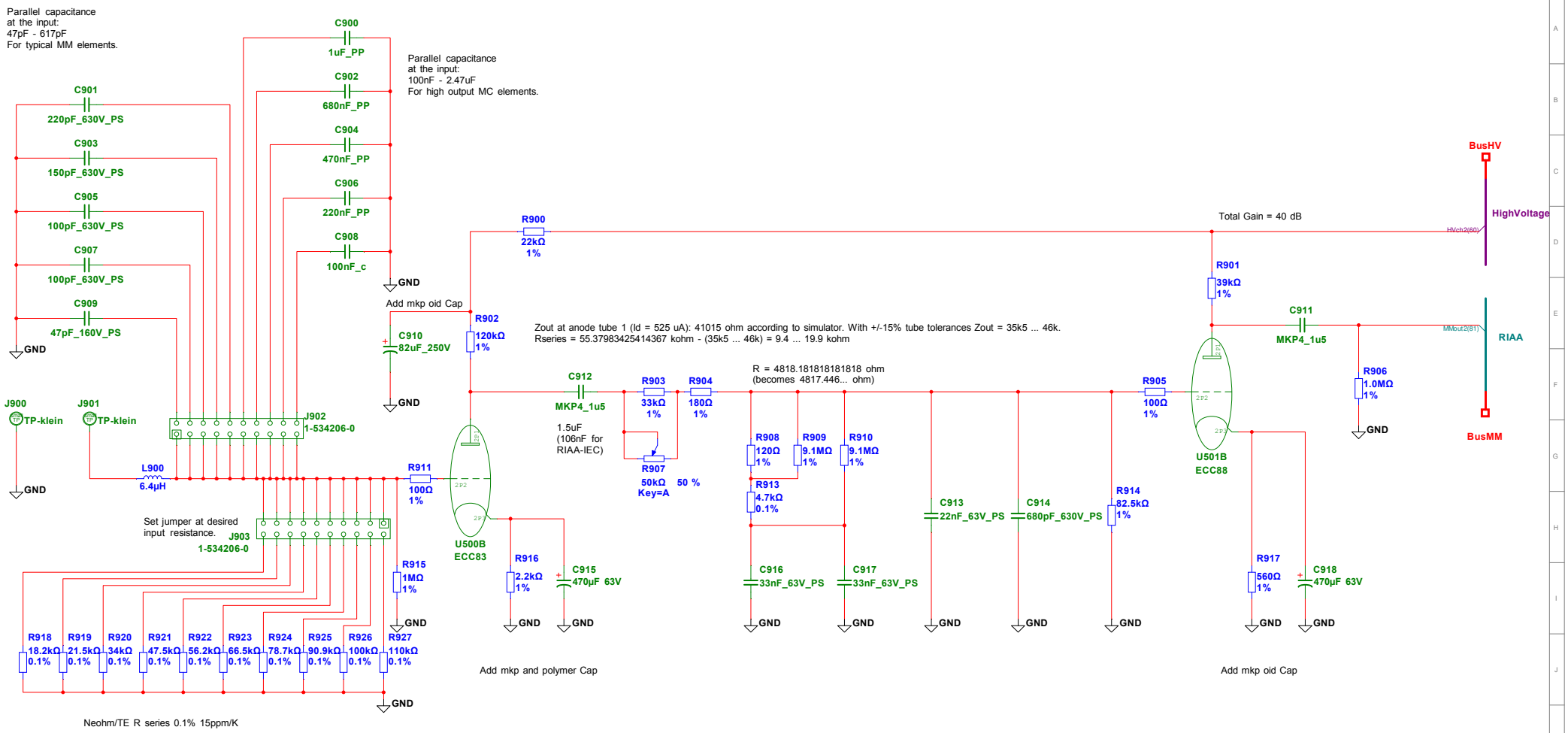
4u7:
Audyn Cap Plus, 1341762
D = 36mm, L = 63mm, d2 = 1.5mm

Audyn Cap Plus, 1341758
D = 25mm, L = 43mm, d2 = 1mm

Audyn Cap Plus, 1341755
D = 25mm, L = 43mm, d2 = 1mm

Expected power consumption:
High Voltage 12 mA
Filament: 2 x 365...475 mA = 950 mA worst case

德克斯 JCAD jcad.design The Netherlands		Project: 0033/RO3	Schematic: RO3_A
Title: Line Driver	Desc.: 2 Channel SRPP/White with feedback		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A1	
Approved by:	Sheet 6 of 10	1st.date: Nov 4, 2017	

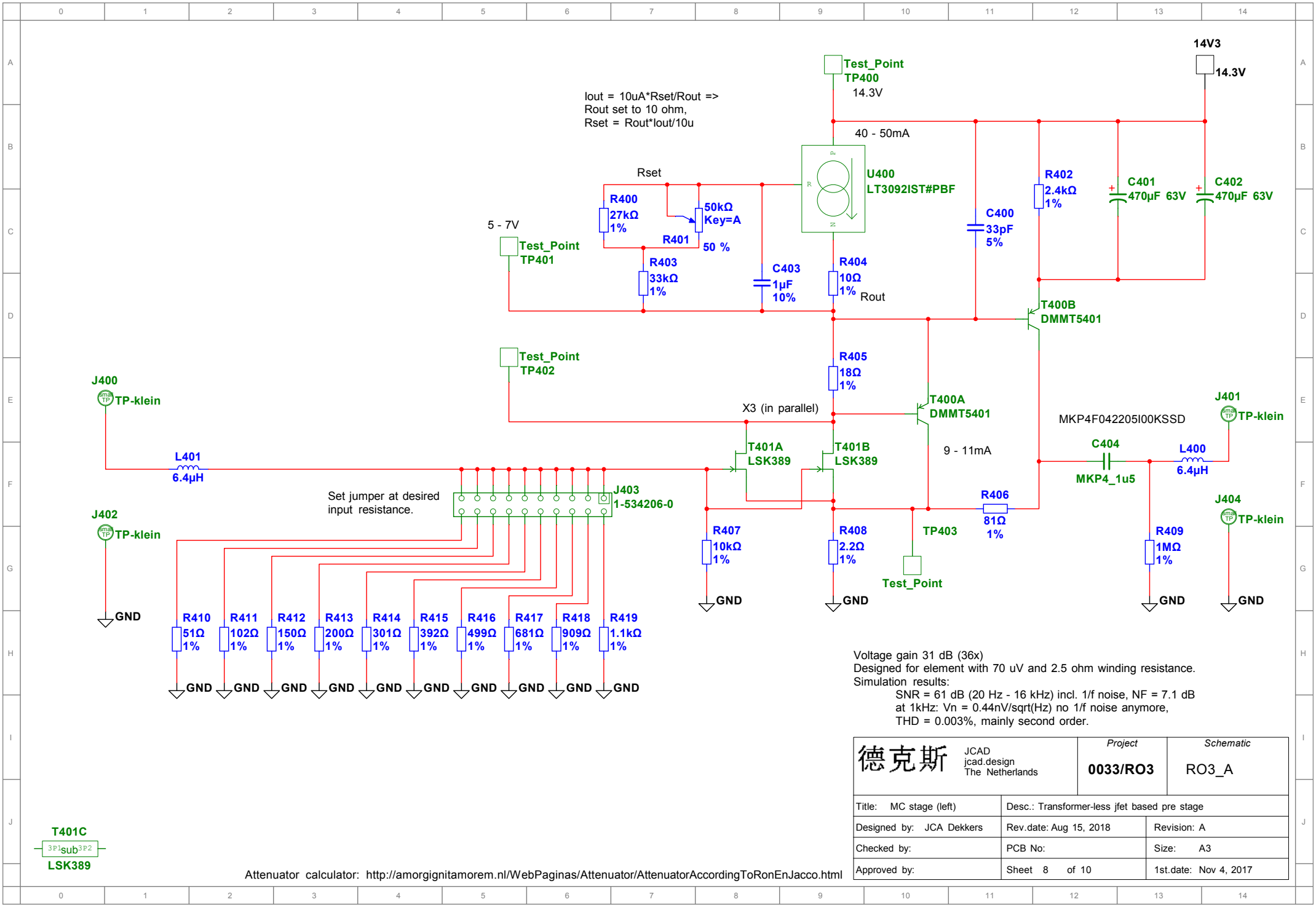


Expected power consumption:
High Voltage 3...6 mA
Filament: 1 x 365...475 mA = 475 mA worst case

Capacitors: LCR Components FSC(/EX) series
Resistors: TE Connectivity/Neohm H8 (Holco), R series
Welwyn RC, RC55, PR (low cost) series
Vishay Dale PTF series
http://nl.farnell.com/webapp/wcs/stores/servlet/Search?catalogId=15001&langId=31&storeId=10168&categoryId=700000005447&pageSize=25&showResults=true&sf=432,502,721&pf=110003727,110075262,110101775,110124724,112067013

Passive RIAA calculator: http://amorgignitamorem.nl/WebPaginas/passieve_RIAA/passieve_RIAA.html

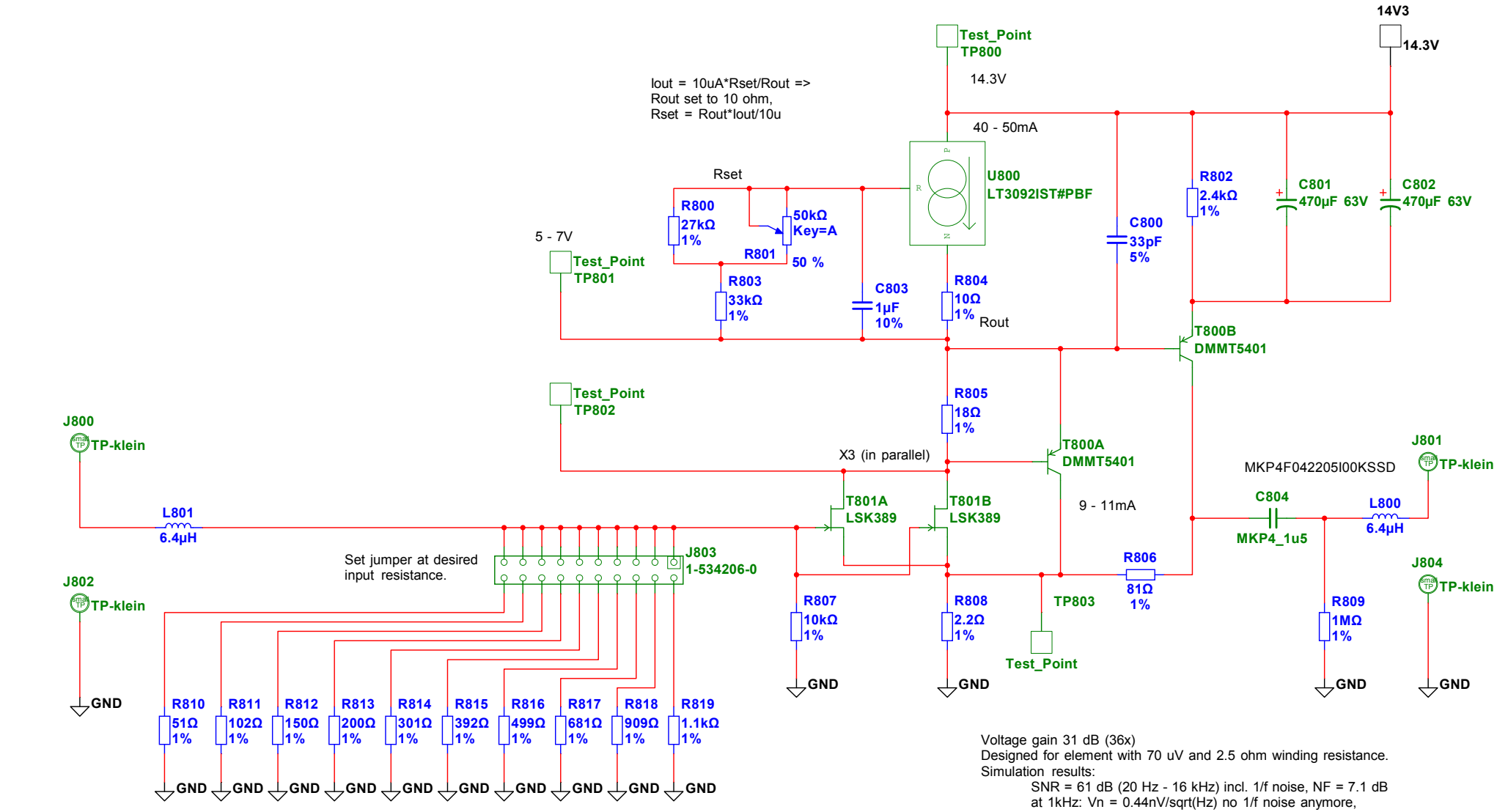
德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: MM RIAA stage (right)	Desc.: Passive RIAA and Input Impedance Selection		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A2	
Approved by:	Sheet 7 of 10	1st.date: Nov 4, 2017	



Voltage gain 31 dB (36x)
Designed for element with 70 uV and 2.5 ohm winding resistance.
Simulation results:
SNR = 61 dB (20 Hz - 16 kHz) incl. 1/f noise, NF = 7.1 dB
at 1kHz: Vn = 0.44nV/sqrt(Hz) no 1/f noise anymore,
THD = 0.003%, mainly second order.

德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: MC stage (left)	Desc.: Transformer-less jfet based pre stage		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A3	
Approved by:	Sheet 8 of 10	1st.date: Nov 4, 2017	

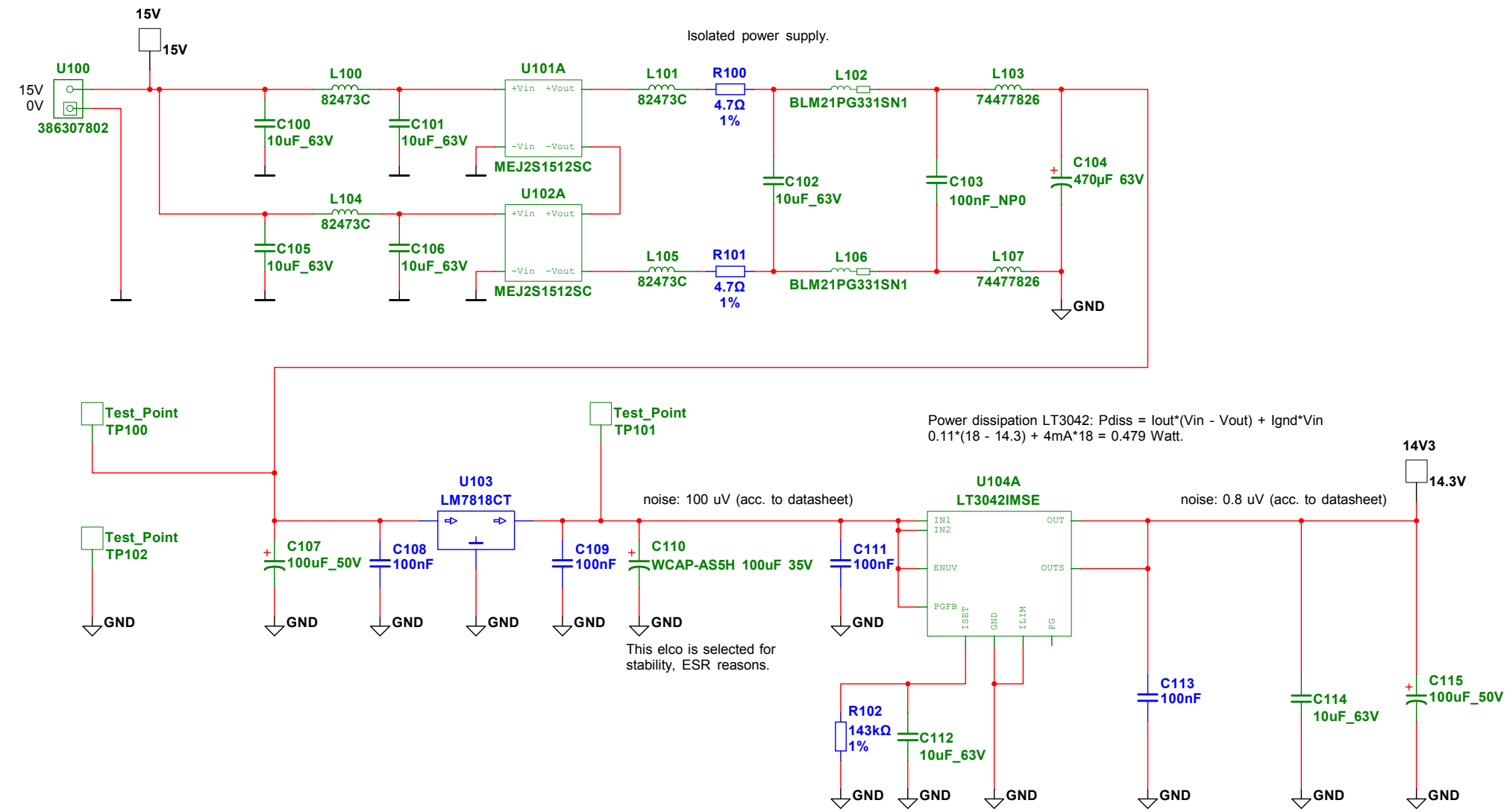
Attenuator calculator: http://amorgignitamorem.nl/WebPaginas/Attenuator/AttenuatorAccordingToRonEnJacco.html



Voltage gain 31 dB (36x)
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Simulation results:
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at 1kHz: Vn = 0.44nV/sqrt(Hz) no 1/f noise anymore,
THD = 0.003%, mainly second order.

Attenuator calculator: http://amorgignitamorem.nl/WebPaginas/Attenuator/AttenuatorAccordingToRonEnJacco.html

德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: MC stage (right)	Desc.: Transformer-less jfet based pre stage		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A3	
Approved by:	Sheet 9 of 10	1st.date: Nov 4, 2017	



德克斯 JCAD jcad.design The Netherlands		*Project* 0033/RO3	*Schematic* RO3_A
Title: PS distribution	Desc.: Distribution and Isolated MC Power Supply		
Designed by: JCA Dekkers	Rev.date: Aug 15, 2018	Revision: A	
Checked by:	PCB No:	Size: A3	
Approved by:	Sheet 10 of 10	1st.date: Nov 4, 2017	