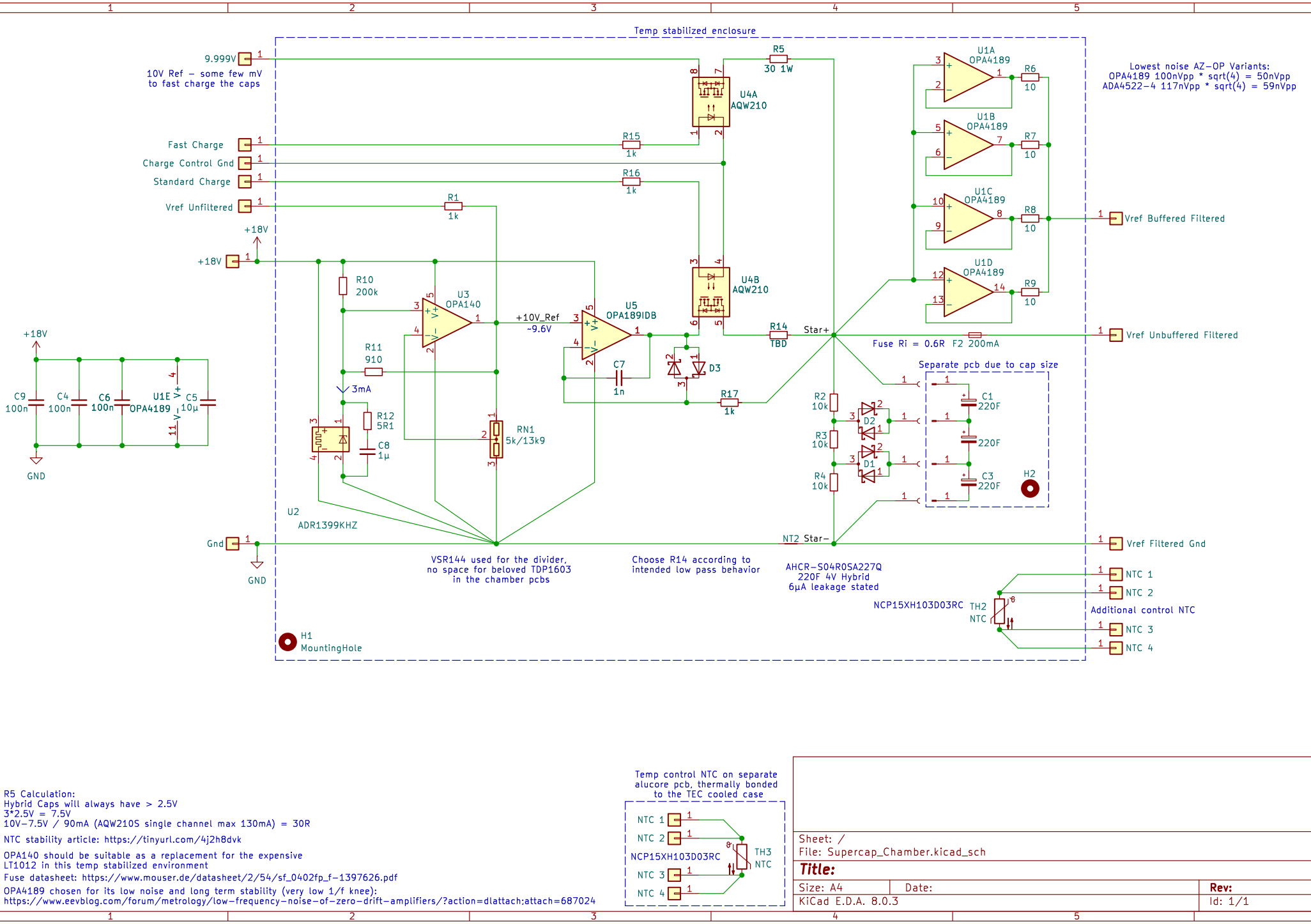
Temp stabilized enclosure
9.999V
10V Ref – some few mV
to fast charge the caps
Fast Charge
Charge Control Gnd
Standard Charge
Vref Unfiltered
+18V
Gnd
GND
R1
1k
R5
30 1W
R15
1k
R16
1k
U4A
AQW210
U4B
AQW210
R10
200k
U3
OPA140
R11
910
3mA
R12
5R1
C8
1µ
RN1
5k/13k9
+10V_Ref
~9.6V
U5
OPA189IDB
C7
1n
D3
R14
TBD
R17
1k
Star+
U1A
OPA4189
U1B
OPA4189
U1C
OPA4189
U1D
OPA4189
R6
10
R7
10
R8
10
R9
10
Vref Buffered Filtered
Vref Unbuffered Filtered
Fuse Ri = 0.6R F2 200mA
Lowest noise AZ-OP Variants:
OPA4189 100nVpp * sqrt(4) = 50nVpp
ADA4522-4 117nVpp * sqrt(4) = 59nVpp
Separate pcb due to cap size
R2
10k
R3
10k
R4
10k
D2
D1
C1
220F
220F
C3
220F
H2
C9
100n
C4
100n
C6
100n
U1E
OPA4189
C5
10µ
U2
ADR1399KHZ
NT2 Star–
Vref Filtered Gnd
VSR144 used for the divider,
no space for beloved TDP1603
in the chamber pcbs
Choose R14 according to
intended low pass behavior
AHCR-S04R0SA227Q
220F 4V Hybrid
6µA leakage stated
NCP15XH103D03RC
TH2
NTC
NTC 1
NTC 2
Additional control NTC
NTC 3
NTC 4
H1
MountingHole
R5 Calculation:
Hybrid Caps will always have > 2.5V
3*2.5V = 7.5V
10V-7.5V / 90mA (AQW210S single channel max 130mA) = 30R
NTC stability article: https://tinyurl.com/4j2h8dvk
OPA140 should be suitable as a replacement for the expensive
LT1012 in this temp stabilized environment
Fuse datasheet: https://www.mouser.de/datasheet/2/54/sf_0402fp_f-1397626.pdf
OPA4189 chosen for its low noise and long term stability (very low 1/f knee):
https://www.eevblog.com/forum/metrology/low-frequency-noise-of-zero-drift-amplifiers/?action=dlattach;attach=687024
Temp control NTC on separate
alucore pcb, thermally bonded
to the TEC cooled case
NTC 1
NTC 2
NCP15XH103D03RC
TH3
NTC
NTC 3
NTC 4
Sheet: /
File: Supercap_Chamber.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 8.0.3
Id: 1/1