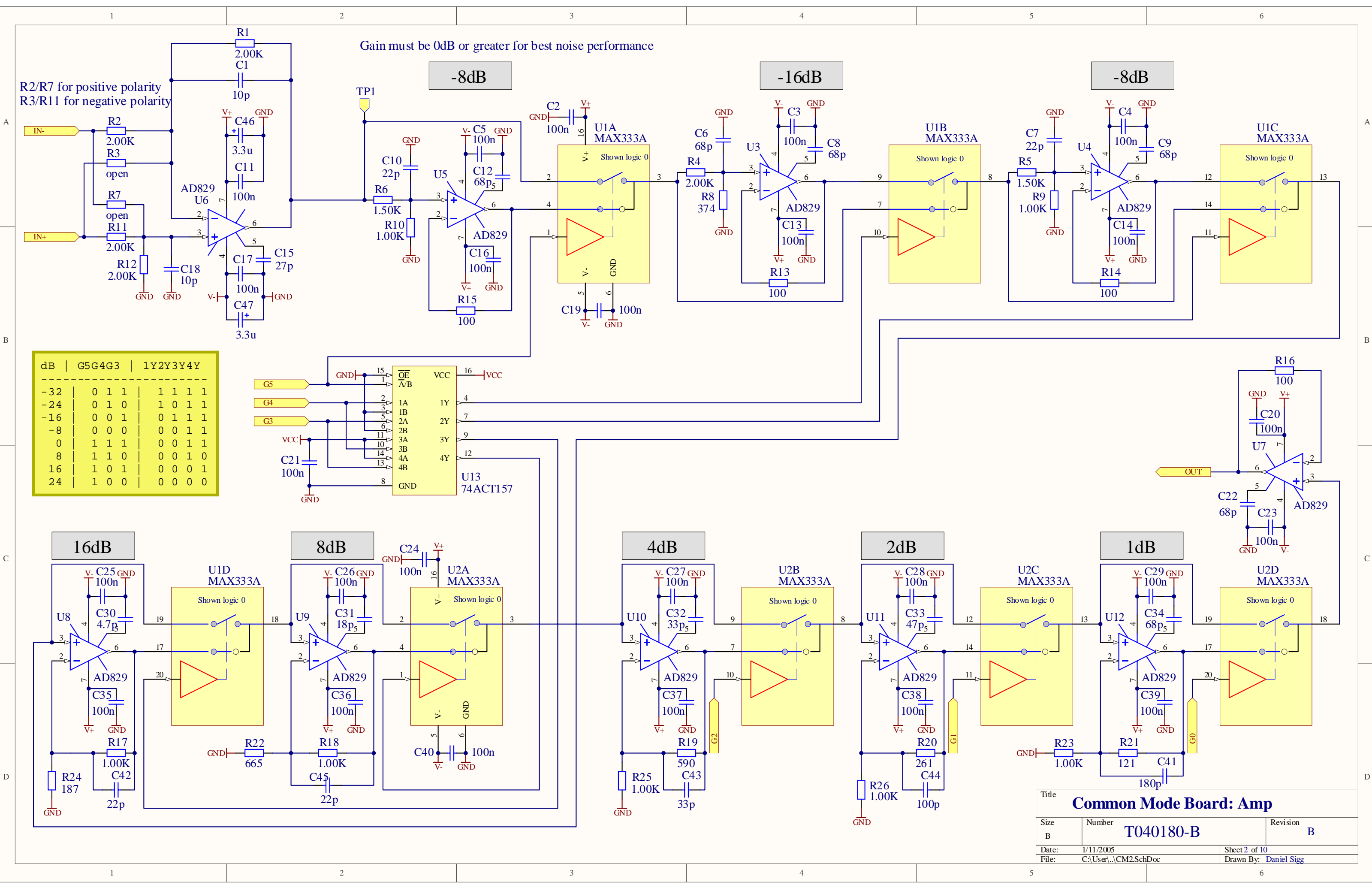


|                          |                        |                       |
|--------------------------|------------------------|-----------------------|
| Title                    |                        |                       |
| <b>Common Mode Board</b> |                        |                       |
| Size                     | Number                 | Revision              |
| B                        | D040180-B              | B                     |
| Date:                    | 1/11/2005              | Sheet 1 of 10         |
| File:                    | C:\User\...\CM1.SchDoc | Drawn By: Daniel Sigg |



Gain must be 0dB or greater for best noise performance

R2/R7 for positive polarity  
R3/R11 for negative polarity

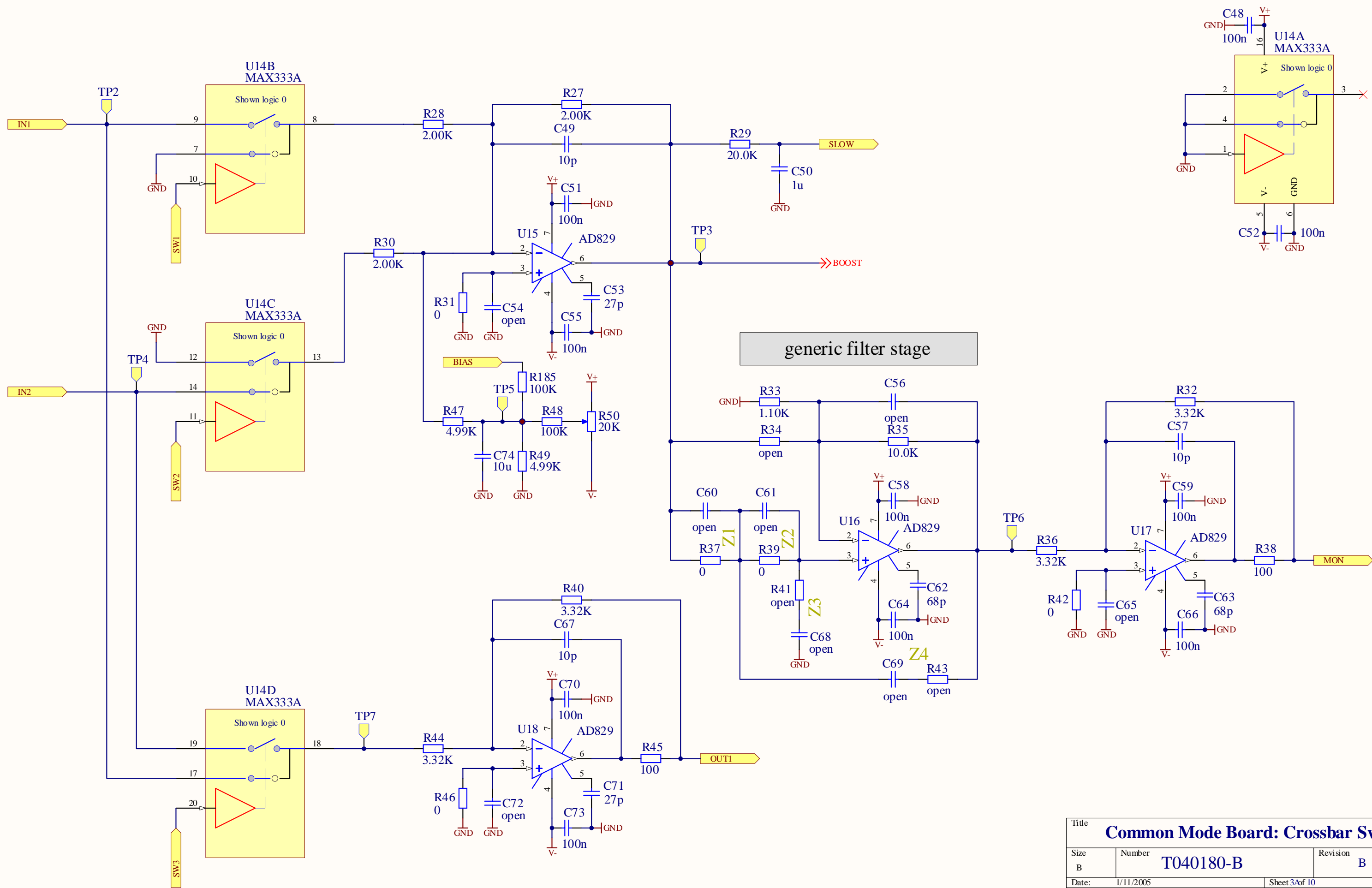
-8dB

-16dB

-8dB

| dB  | G5 | G4 | G3 | 1Y | 2Y | 3Y | 4Y |
|-----|----|----|----|----|----|----|----|
| -32 | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
| -24 | 0  | 1  | 0  | 1  | 0  | 1  | 1  |
| -16 | 0  | 0  | 1  | 0  | 1  | 1  | 1  |
| -8  | 0  | 0  | 0  | 0  | 0  | 1  | 1  |
| 0   | 1  | 1  | 1  | 0  | 0  | 1  | 1  |
| 8   | 1  | 1  | 0  | 0  | 0  | 1  | 0  |
| 16  | 1  | 0  | 1  | 0  | 0  | 0  | 1  |
| 24  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |

|  |                            |               |
|--|----------------------------|---------------|
| Title<br><b>Common Mode Board: Amp</b> |                            |               |
| Size<br>B                              | Number<br><b>T040180-B</b> | Revision<br>B |
| Date:<br>1/11/2005                     | Sheet 2 of 10              |               |
| File:<br>C:\User\...\CM2.SchDoc        | Drawn By:<br>Daniel Sigg   |               |



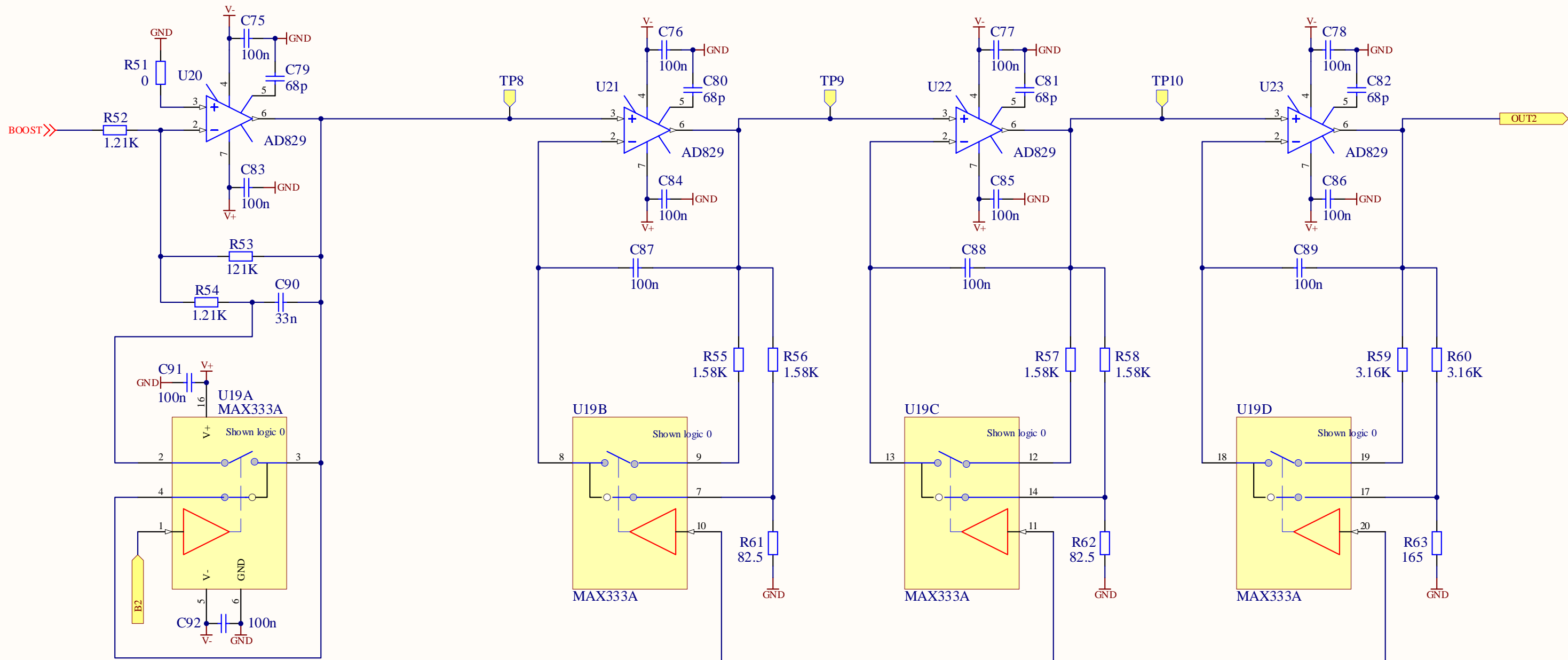
|   |                          |                       |
|---|--------------------------|-----------------------|
| Title                                     |                          |                       |
| <b>Common Mode Board: Crossbar Switch</b> |                          |                       |
| Size                                      | Number                   | Revision              |
| B   | T040180-B                | B                     |
| Date:                                     | 1/11/2005                | Sheet 3 of 10         |
| File:                                     | C:\User\d...CM3A.Sch Doc | Drawn By: Daniel Sigg |

40Hz/4kHz pole/zero pair

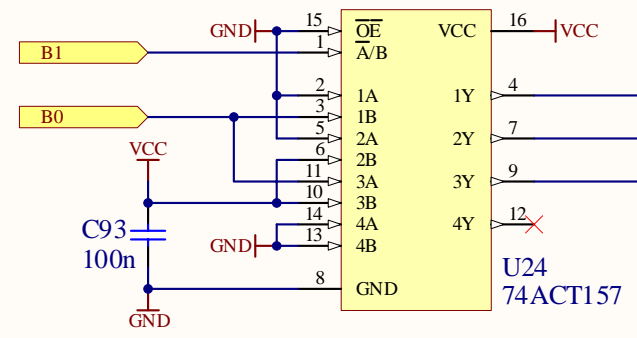
1kHz/20kHz pole/zero pair

1kHz/20kHz pole/zero pair

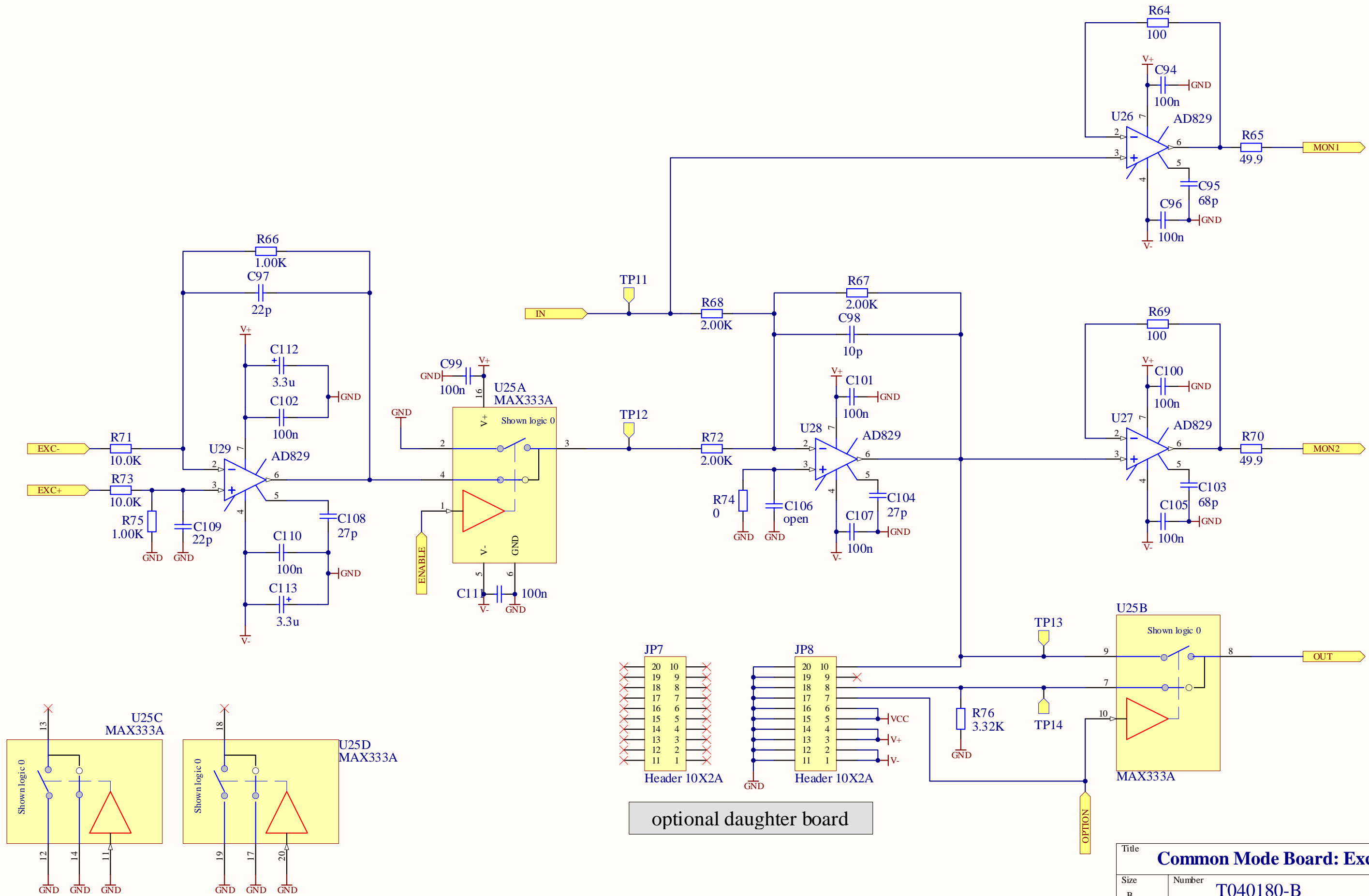
500Hz/10kHz pole/zero pair



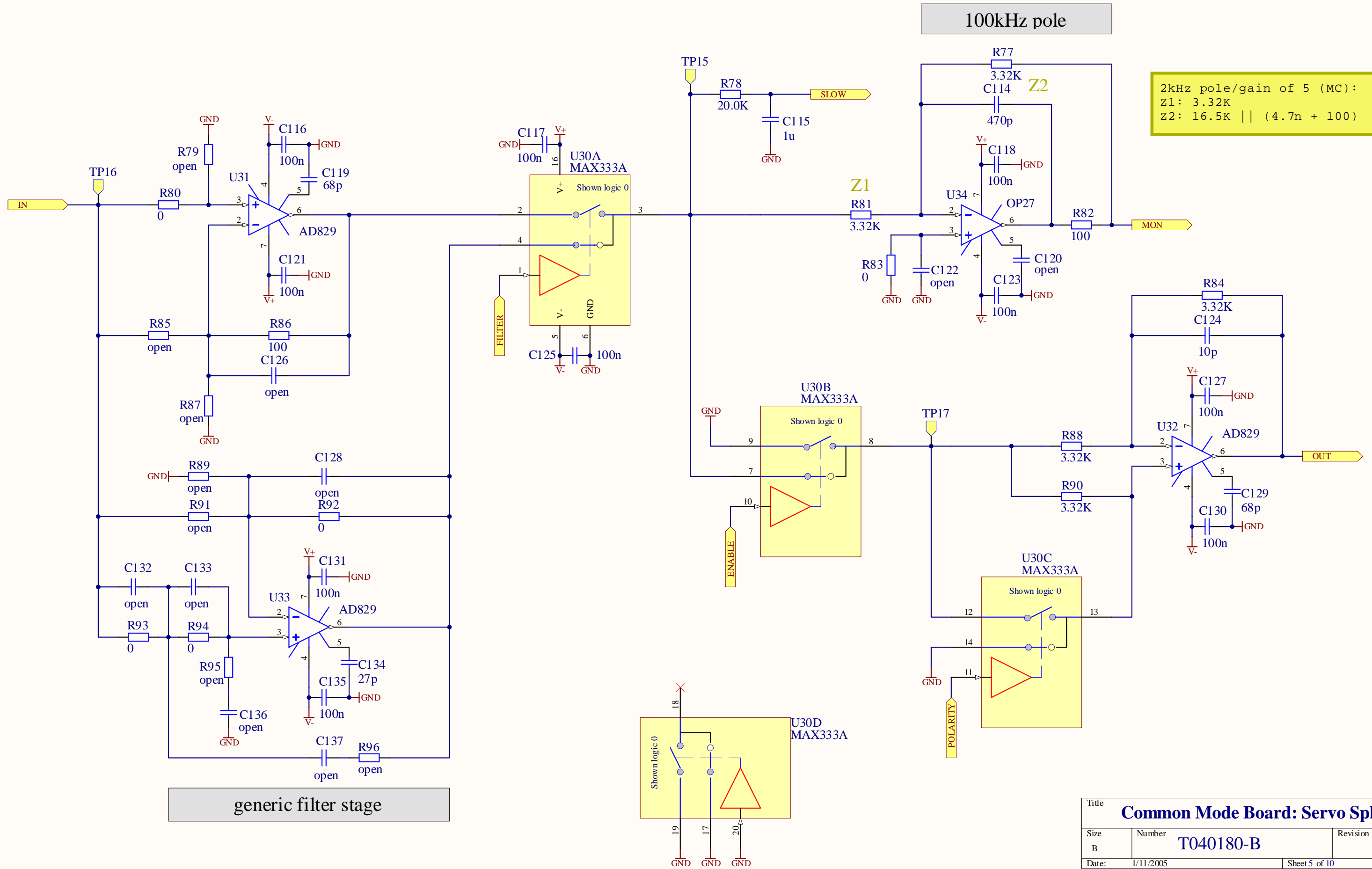
| Boosts | B1B0 | 1Y2Y3Y |
|--------|------|--------|
| 0      | 1 1  | 1 1 1  |
| 1      | 1 0  | 0 1 1  |
| 2      | 0 1  | 0 0 1  |
| 3      | 0 0  | 0 0 0  |



|  |                            |               |
|--|----------------------------|---------------|
| Title<br><b>Common Mode Board: Boost</b> |                            |               |
| Size<br>B                                | Number<br><b>T040180-B</b> | Revision<br>B |
| Date:<br>1/11/2005                       | Sheet 3Bof 10              |               |
| File:<br>C:\User\...\CM3B.SchDoc         | Drawn By:<br>Daniel Sigg   |               |



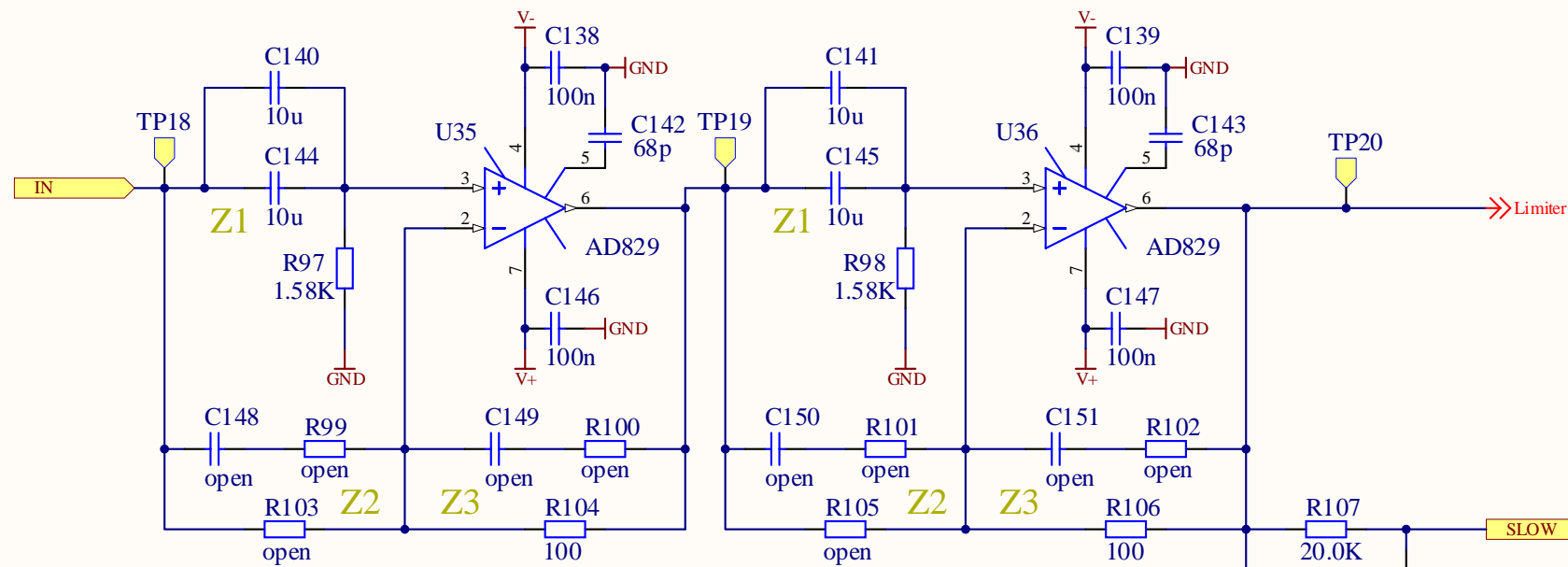
|   |                            |               |
|---|----------------------------|---------------|
| Title<br><b>Common Mode Board: Excitation Point</b> |                            |               |
| Size<br>B   | Number<br><b>T040180-B</b> | Revision<br>B |
| Date:<br>1/11/2005                                  | Sheet 4 of 10              |               |
| File:<br>C:\User\...\CM4.SchDoc                     | Drawn By: Daniel Sigg      |               |



|                                       |                        |                       |
|---------------------------------------|------------------------|-----------------------|
| Title                                 |                        |                       |
| <b>Common Mode Board: Servo Split</b> |                        |                       |
| Size                                  | Number                 | Revision              |
| B                                     | <b>T040180-B</b>       | B                     |
| Date:                                 | 1/11/2005              | Sheet 5 of 10         |
| File:                                 | C:\User\...\CM5.SchDoc | Drawn By: Daniel Sigg |

5Hz high pass

5Hz high pass



70kHz zero/140kHz pole (MC):  
 Z1: 0 Ohm to ground  
 Z2:  $(1n + 1.13K) \parallel 1.13K$   
 Z3:  $1.13K \parallel 10p$

voltage follower for MC:  
 Z1: 0 Ohm  
 Z2: open  
 Z3: 100 Ohm

Filter Design Examples:

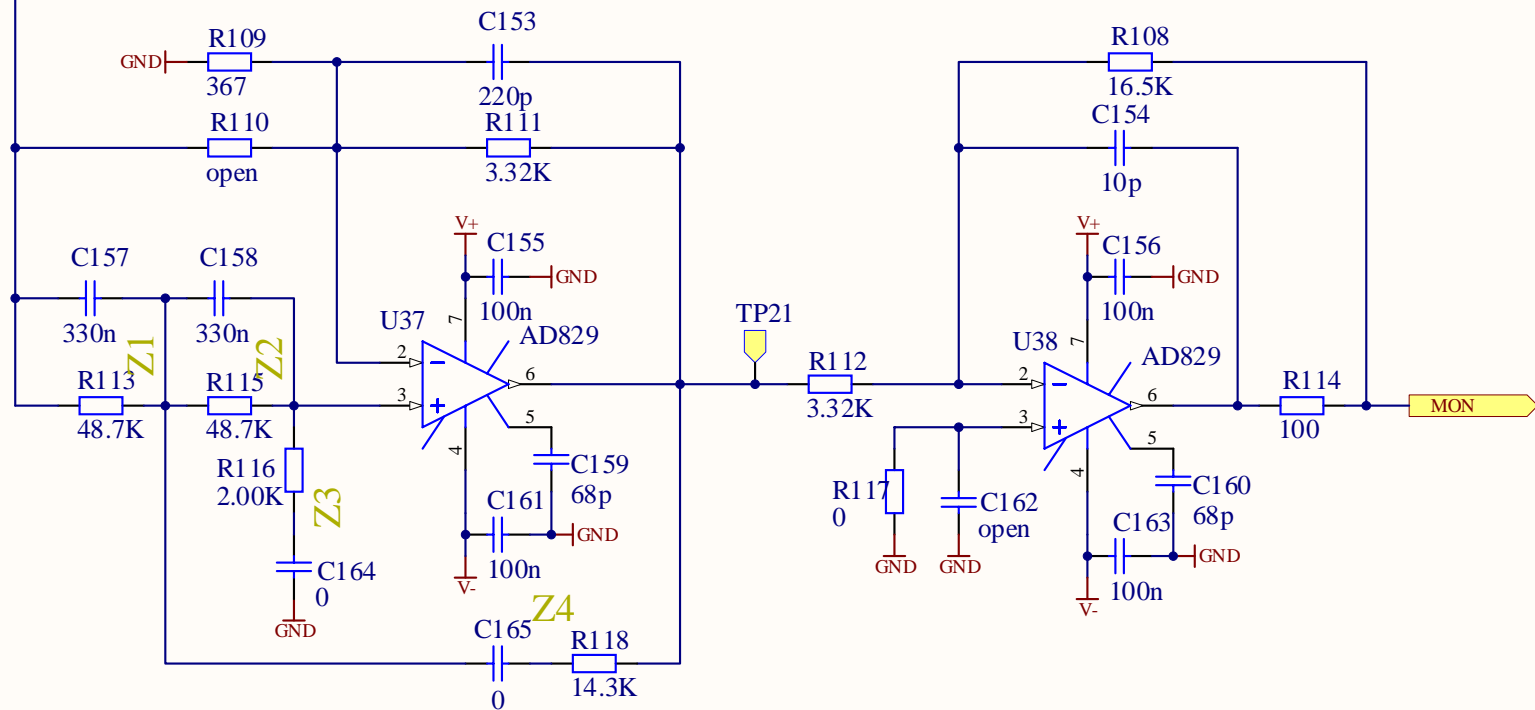
Butterworth high pass:  $G = 1.586$ ,  $Z1 = Z2 = 1/sC$ ,  $Z3 = Z4 = R$   
 two zeros at 0Hz, two complex poles at  $f = 1/(2 \pi R C)$

Butterworth low pass:  $G = 1.586$ ,  $Z1 = Z2 = R$ ,  $Z3 = Z4 = 1/sC$   
 two complex poles at  $f = 1/(2 \pi R C)$

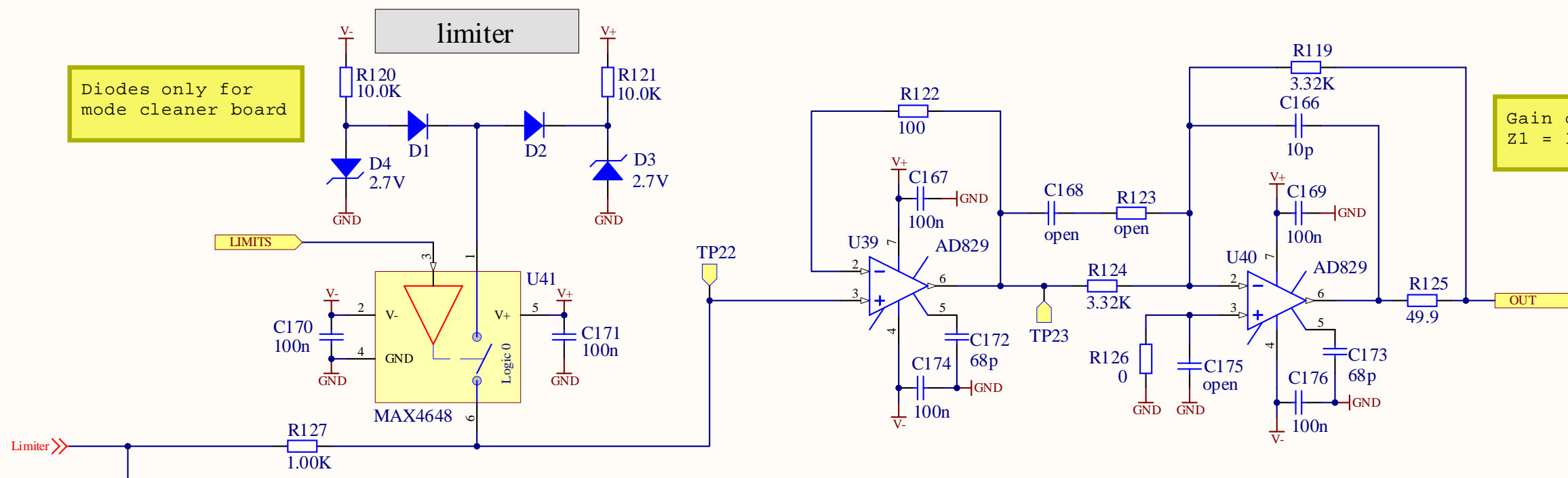
Whitening:  $G = 1$ ,  $Z1 = Z2 = (1/sC) \parallel R2$ ,  $Z3 = Z4 = R1$   
 two real zeros at  $f = 1/(2 \pi R2 C)$ , two real poles at  $f = 1/(2 \pi (R1 \parallel R2) C)$

Dewhitening:  $G = 1$ ,  $Z1 = Z2 = R1$ ,  $Z3 = Z4 = 1/sC + R2$   
 two real poles at  $f = 1/(2 \pi (R1 + R2) C)$ , two real zeros at  $f = 1/(2 \pi R2 C)$

generic filter stage  
 2 real zeros at 10Hz  
 2 real poles at 100Hz  
 dc gain of 0.1



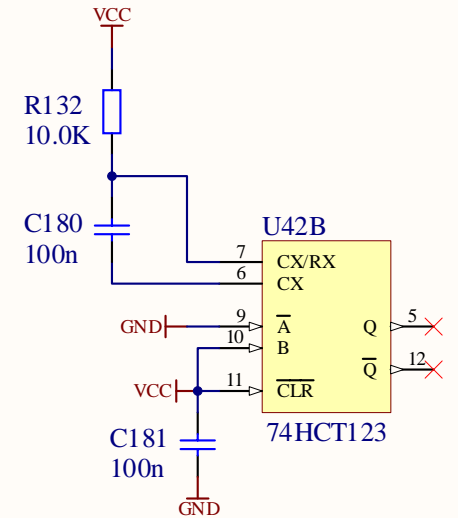
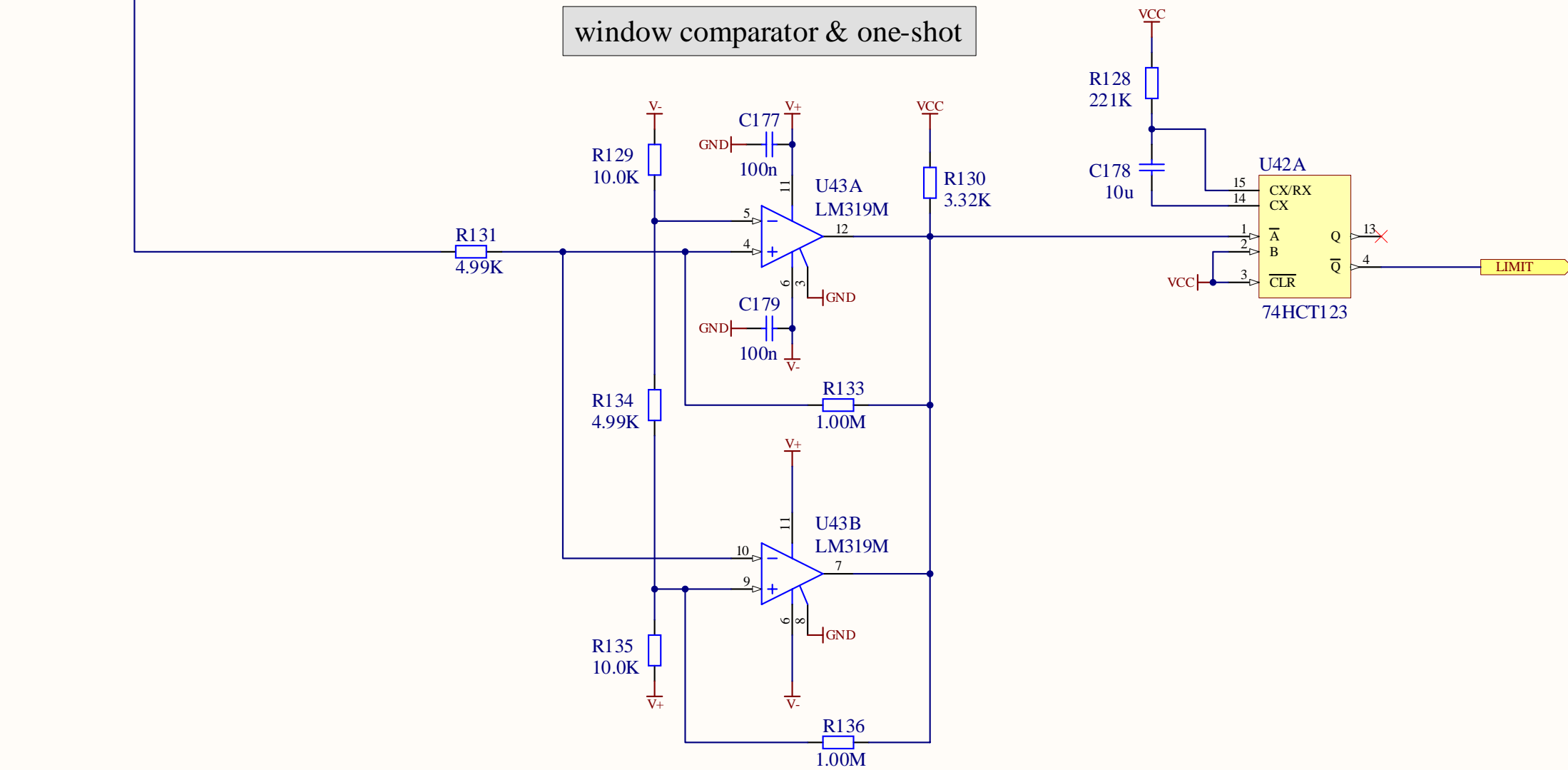
|                                     |                          |                       |
|-------------------------------------|--------------------------|-----------------------|
| Title                               |                          |                       |
| <b>Common Mode Board: Fast Path</b> |                          |                       |
| Size                                | Number                   | Revision              |
| B                                   | T040180-B                | B                     |
| Date:                               | 1/11/2005                | Sheet 6 of 10         |
| File:                               | C:\User\...\CM6A.Sch.Doc | Drawn By: Daniel Sigg |



Diodes only for mode cleaner board

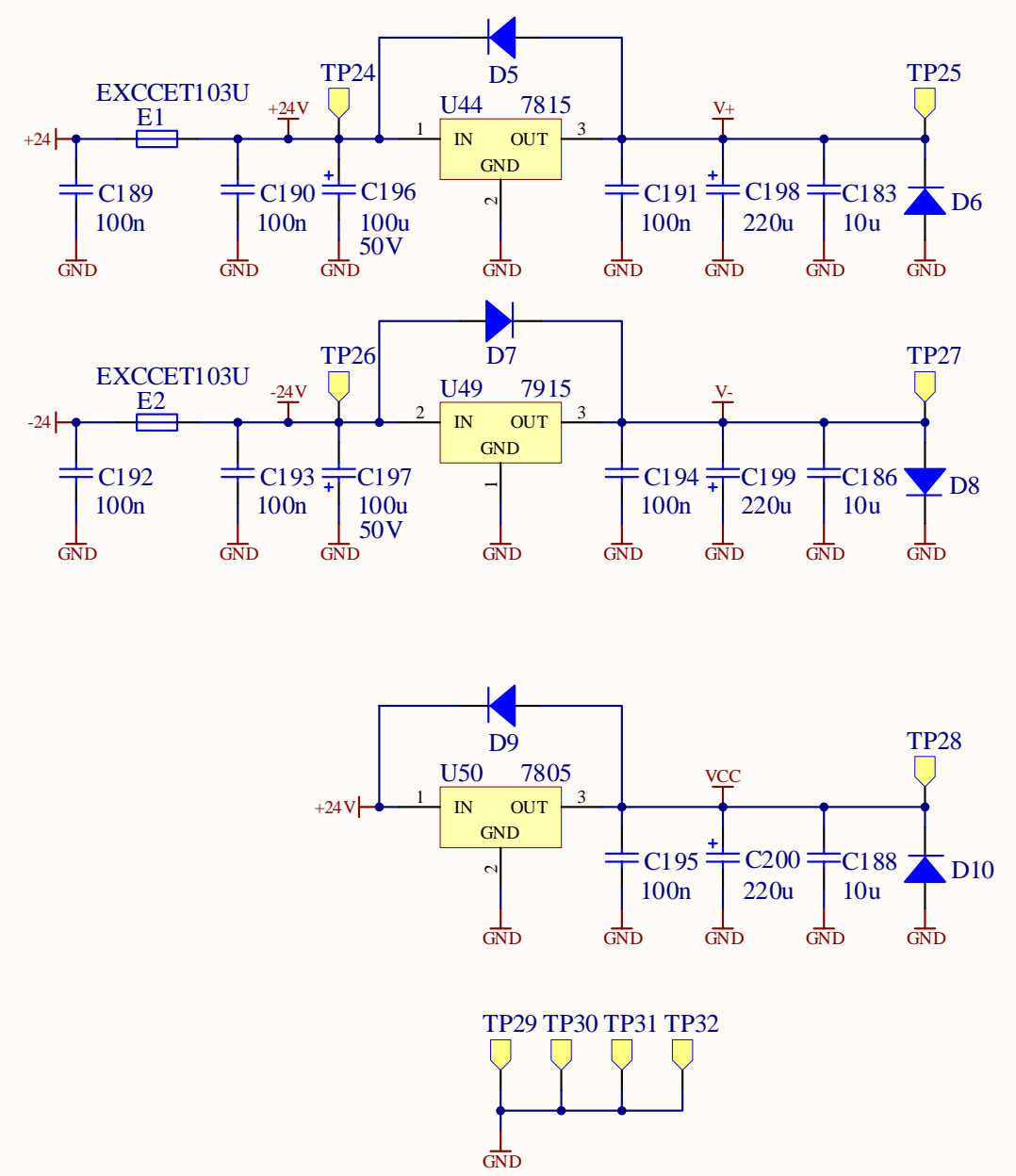
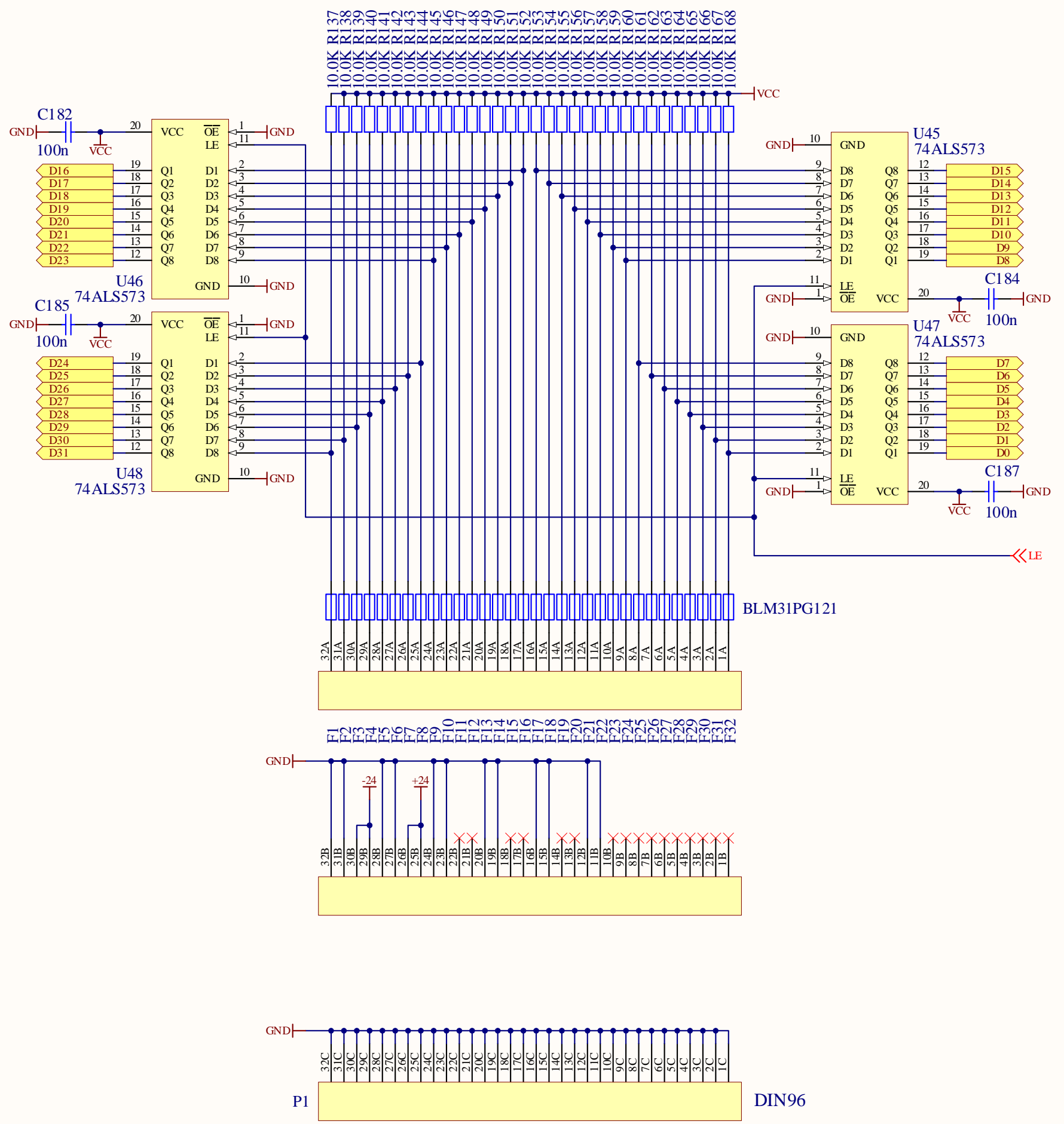
Gain of 1/2 (MC):  
 $Z1 = 1.65K \parallel (18p + 49.9)$

window comparator & one-shot

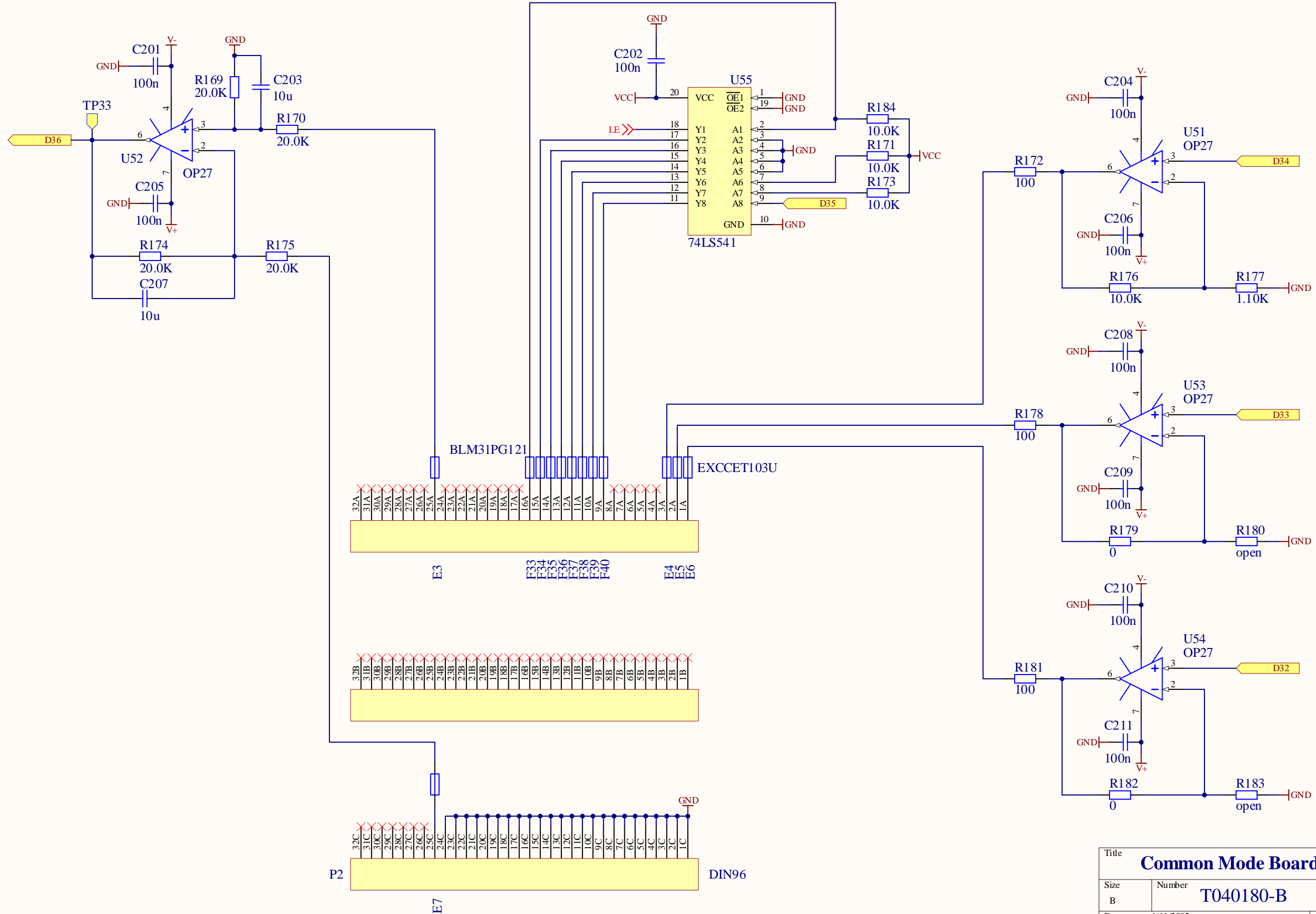


|  |                         |                       |
|--|-------------------------|-----------------------|
| Title                                    |                         |                       |
| <b>Common Mode Board: Output Limiter</b> |                         |                       |
| Size                                     | Number                  | Revision              |
| B  | T040180-B               | B                     |
| Date:                                    | 1/11/2005               | Sheet 6Bof 10         |
| File:                                    | C:\User\...\CM6B.SchDoc | Drawn By: Daniel Sigg |





|   |                          |                       |
|---|--------------------------|-----------------------|
| Title                                   |                          |                       |
| <b>Common Mode Board: Backplane(P1)</b> |                          |                       |
| Size                                    | Number                   | Revision              |
| B                                       | <b>T040180-B</b>         | B                     |
| Date:                                   | 1/11/2005                | Sheet 7 of 10         |
| File:                                   | C:\User\...\CM7A.Sch.Doc | Drawn By: Daniel Sigg |



|   |                         |                       |
|---|-------------------------|-----------------------|
| Title                                   |                         |                       |
| <b>Common Mode Board: Backplane(P2)</b> |                         |                       |
| Size                                    | Number                  | Revision              |
| B                                       | <b>T040180-B</b>        | B                     |
| Date:                                   | 1/11/2005               | Sheet 7Bof 10         |
| File:                                   | C:\User\...\CM7B.SchDoc | Drawn By: Daniel Sigg |