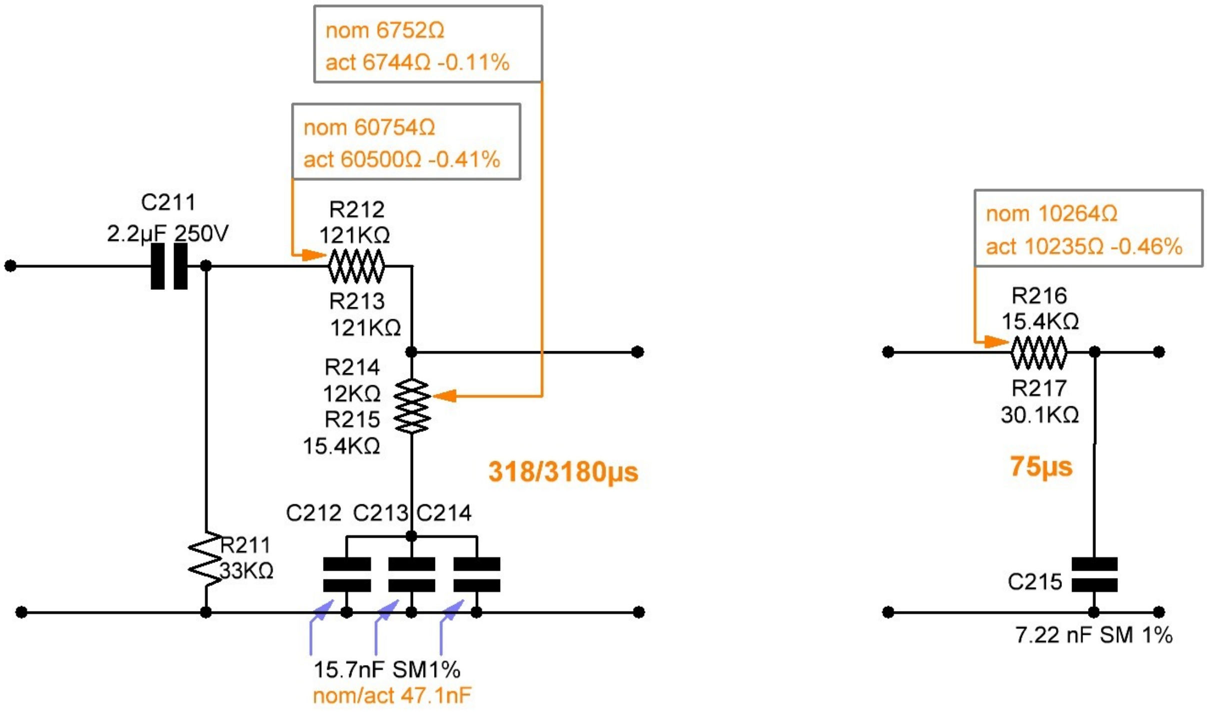

When driven from an ideal voltage source and loaded by an infinite impedance, the network on the right simply has a pole at -1/*RC* where *R* is the parallel value of the two resistors and *C* is the capacitance of the capacitor. The values annotated on the schematic are a bit off for some reason - correction for finite source resistance and nonzero load capacitance maybe?

Besides the zero in the origin due to the AC coupling, the network on the left has a zero determined exclusively by R_{214} in parallel with R_{215} and the parallel value of C_{212}, C_{213} and C_{214}.

Determining the poles for the network on the left is a bit more difficult. I will again assume it is driven from an ideal voltage source and loaded by an infinite impedance.

For simplicity, call

$C_A := C_{211}$

$R_A := R_{211}$

$$R_B := \frac{R_{212} R_{213}}{R_{212}+R_{213}} + \frac{R_{214} R_{215}}{R_{214}+R_{215}}$$

$C_B := C_{212} + C_{213} + C_{214}$

Calculating the input admittance shows that the characteristic polynomial is

$$s^2 R_A R_B C_A C_B + s\left(R_A C_B + R_B C_B + R_A C_A\right) + 1$$

When the component values are given, the pole positions are

$$p_{1,2}=\frac{-\left(R_{A}C_{B}+R_{B}C_{B}+R_{A}C_{A}\right)\pm\sqrt{\left(R_{A}C_{B}+R_{B}C_{B}+R_{A}C_{A}\right)^{2}-4R_{A}R_{B}C_{A}C_{B}}}{2R_{A}R_{B}C_{A}C_{B}}$$

and the corresponding time constants are by definition

$$\tau_{1,2}=-\frac{1}{p_{1,2}}$$

Conversely, when the desired time constants and resistances are given:

Desired characteristic polynomial:

$$(s\tau_{1}+1)(s\tau_{2}+1)=s^{2}\tau_{1}\tau_{2}+s(\tau_{1}+\tau_{2})+1$$

Hence,

$$R_{A}=\frac{\tau_{1}\tau_{2}}{C_{A}C_{B}R_{B}}$$

and

$$\tau_{1}+\tau_{2}=R_{A}C_{B}+R_{B}C_{B}+R_{A}C_{A}=\frac{C_{A}+C_{B}}{C_{A}C_{B}}\tau_{1}\tau_{2}\frac{1}{R_{B}}+C_{B}R_{B}$$

Bringing everything to one side and multiplying by R_B turns this into a standard quadratic equation:

$$C_{B}R_{B}^{2}-(\tau_{1}+\tau_{2})R_{B}+\frac{C_{A}+C_{B}}{C_{A}C_{B}}\tau_{1}\tau_{2}=0$$

Hence, the solution is

$$R_{B\,1,2}=\frac{\tau_{1}+\tau_{2}\pm\sqrt{(\tau_{1}+\tau_{2})^{2}-4\frac{C_{A}+C_{B}}{C_{A}}\tau_{1}\tau_{2}}}{2C_{B}}$$

The solution with the minus sign will usually be the desired one. Using

$$R_{A}=\frac{\tau_{1}\tau_{2}}{C_{A}C_{B}R_{B}}$$

both resistances are now known.