

**Experiment: TIA Z1 ZL**

**Filter 1**

Invalid filter  
 $Z(s)$ :  $(R_1, \infty, \infty, \infty, \infty, \infty, R_L)$

**Filter 2**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$

**Filter 3**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$

**Filter 4**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$

**Filter 5**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

**Filter 6**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

**Filter 7**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$

**Filter 8**

**Filter Type:** BP

$Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L + \frac{1}{C_L s}}}\right)$   
 $H(s)$ :  $\frac{L_L R_L R_L g_m s}{(R_L g_m + 1)(C_L L_L R_L s^2 + L_L s + R_L)}$   
**Q:**  $C_L R_L \sqrt{\frac{1}{C_L L_L}}$   
 $\omega_0$ :  $\sqrt{\frac{1}{C_L L_L}}$   
**Bandwidth:**  $\frac{1}{C_L R_L}$

**Filter 9**

Invalid filter  
 $Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

**Filter 10**

**Filter Type:** BS

$Z(s)$ :  $\left(R_1, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$   
 $H(s)$ :  $\frac{R_L R_L g_m (C_L L_L s^2 + 1)}{(R_L g_m + 1)(C_L L_L s^2 + C_L R_L s + 1)}$   
**Q:**  $\frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L}$   
 $\omega_0$ :  $\sqrt{\frac{1}{C_L L_L}}$   
**Bandwidth:**  $\frac{R_L}{L_L}$

**Filter 11**

Invalid filter  
 $Z(s)$ :  $(L_1 s, \infty, \infty, \infty, \infty, \infty, R_L)$

**Filter 12**

Invalid filter  
 $Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$

**Filter 13**

**Filter Type:** BP

$Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$   
 $H(s)$ :  $\frac{L_1 R_L g_m s}{(C_L R_L s + 1)(L_1 g_m s + 1)}$   
**Q:**  $\frac{C_L L_1 R_L g_m \sqrt{\frac{1}{C_L L_1 R_L g_m}}}{C_L R_L + L_1 g_m}$   
 $\omega_0$ :  $\sqrt{\frac{1}{C_L L_1 R_L g_m}}$   
**Bandwidth:**  $\frac{C_L R_L + L_1 g_m}{C_L L_1 R_L g_m}$

**Filter 14**

Invalid filter  
 $Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$

**Filter 15**

Invalid filter  
 $Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

**Filter 16**

**Filter Type:** HP

$Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$   
 $H(s)$ :  $\frac{L_L L_L g_m s^2}{(C_L L_L s^2 + 1)(L_1 g_m s + 1)}$   
**Q:**  $\frac{C_L L_L \sqrt{\frac{1}{C_L L_L}}}{L_1 g_m}$   
 $\omega_0$ :  $\sqrt{\frac{1}{C_L L_L}}$   
**Bandwidth:**  $\frac{L_L g_m}{C_L L_L}$

**Filter 17**

Invalid filter  
 $Z(s)$ :  $\left(L_1 s, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$

**Filter 18**

**Filter Type:** HP

$$Z(s)\colon \left(L_1s,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$

$$H(s)\colon \frac{L_LL_LR_Lg_ms^2}{(L_1g_m+1)(C_LL_LR_Ls^2+L_Ls+R_L)}$$

$$\mathbf{Q}\colon \frac{L_L\sqrt{\frac{R_L}{L_L(C_LR_L+L_1g_m)}}(C_LR_L+L_1g_m)}{L_LR_Lg_m+L_L}$$

$$\omega_0\colon \sqrt{\frac{R_L}{L_L(C_LR_L+L_1g_m)}}$$

$$\mathbf{Bandwidth}\colon \frac{L_LR_Lg_m+L_L}{L_L(C_LR_L+L_1g_m)}$$

**Filter 19**

Invalid filter

$$Z(s)\colon \left(L_1s,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

**Filter 20**

Invalid filter

$$Z(s)\colon \left(L_1s,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_L^2}\right)}{L_Ls+R_L+\frac{1}{C_L^2}}\right)$$

**Filter 21**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L\right)$$

**Filter 22**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$$

**Filter 23**

**Filter Type:** LP

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$$

$$H(s)\colon \frac{R_Lg_m}{(C_Ls+g_m)(C_LR_Ls+1)}$$

$$\mathbf{Q}\colon -\frac{C_LC_LR_L\sqrt{C_L^2R_L}}{C_L+C_LR_Lg_m}$$

$$\omega_0\colon \sqrt{\frac{g_m}{C_LC_LR_L}}$$

$$\mathbf{Bandwidth}\colon \frac{C_L+C_LR_Lg_m}{C_LC_LR_L}$$

**Filter 24**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$$

**Filter 25**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$$

**Filter 26**

**Filter Type:** BP

$$Z(s)\colon \left(\frac{1}{C_Ls},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$$

$$H(s)\colon \frac{L_Lg_ms}{(C_Ls+g_m)(C_LL_Ls^2+1)}$$

$$\mathbf{Q}\colon \frac{C_LL_Lg_m\sqrt{C_L^2L_L}}{C_L}$$

$$\omega_0\colon \sqrt{\frac{1}{C_LL_L}}$$

$$\mathbf{Bandwidth}\colon \frac{C_L}{C_LL_Lg_m}$$

**Filter 27**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$$

**Filter 28**

**Filter Type:** BP

$$Z(s)\colon \left(\frac{1}{C_Ls},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$

$$H(s)\colon \frac{L_LR_Lg_ms}{(C_Ls+g_m)(C_LL_LR_Ls^2+L_Ls+R_L)}$$

$$\mathbf{Q}\colon \frac{L_L\sqrt{\frac{R_Lg_m}{L_L(C_L+C_LR_Lg_m)}}(C_L+C_LR_Lg_m)}{C_LR_L+L_Lg_m}$$

$$\omega_0\colon \sqrt{\frac{R_Lg_m}{L_L(C_L+C_LR_Lg_m)}}$$

$$\mathbf{Bandwidth}\colon \frac{C_LR_L+L_Lg_m}{L_L(C_L+C_LR_Lg_m)}$$

**Filter 29**

**Filter Type:** GE

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

$$H(s)\colon \frac{g_m(C_LL_LR_Ls^2+L_Ls+R_L)}{(C_Ls+g_m)(C_LL_Ls^2+1)}$$

$$\mathbf{Q}\colon \frac{C_LL_Lg_m\sqrt{C_L^2L_L}}{C_L}$$

$$\omega_0\colon \sqrt{\frac{1}{C_LL_L}}$$

$$\mathbf{Bandwidth}\colon \frac{C_L}{C_LL_Lg_m}$$

$$\mathbf{Qz}\colon C_LR_L\sqrt{\frac{1}{C_L^2L_L}}$$

**Filter 30**

Invalid filter

$$Z(s)\colon \left(\frac{1}{C_L^2s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_L^2}\right)}{L_Ls+R_L+\frac{1}{C_L^2}}\right)$$

**Filter 31**

Invalid filter

$$Z(s)\colon \left(\frac{R_L}{C_LR_L+1},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L\right)$$

**Filter 32**

Invalid filter

$$Z(s)\colon \left(\frac{R_L}{C_LR_L+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$$

**Filter 33****Filter Type:** LP

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s): \frac{R_1 R_L g_m}{(C_L R_L s + 1)(C_1 R_1 s + R_1 g_m + 1)}$$

$$\mathbf{Q}: \frac{C_1 C_L R_1 R_L \sqrt{\frac{R_1 g_m + 1}{C_1^2 R_1^2 R_L^2 g_m}}}{C_1 R_1 + C_L R_1 R_L g_m + C_L R_L}$$

$$\omega_0: \sqrt{\frac{R_1 g_m + 1}{C_1 C_L R_1 R_L}}$$

$$\text{Bandwidth: } \frac{C_1 R_1 + C_L R_1 R_L g_m + C_L R_L}{C_1 C_L R_1 R_L}$$

**Filter 34**

Invalid filter

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$$

**Filter 35**

Invalid filter

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$$

**Filter 36****Filter Type:** BP

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s): \frac{L_L R_1 g_m s}{(C_1 L_L s^2 + 1)(C_1 R_1 s + R_1 g_m + 1)}$$

$$\mathbf{Q}: \frac{C_L L_L \sqrt{\frac{1}{C_1^2 L_L^2}} (R_1 g_m + 1)}{C_1 R_1}$$

$$\omega_0: \sqrt{\frac{1}{C_L L_L}}$$

$$\text{Bandwidth: } \frac{C_1 R_1}{C_L L_L (R_1 g_m + 1)}$$

**Filter 37**

Invalid filter

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$$

**Filter 38****Filter Type:** BP

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{C_L s}} \right)$$

$$H(s): \frac{L_L R_1 R_L g_m s}{(C_1 R_1 s + R_1 g_m + 1)(C_L L_L R_L s^2 + L_L s + R_L)}$$

$$\mathbf{Q}: \frac{L_L \sqrt{\frac{R_1 (R_1 g_m + 1)}{L_L (C_1 R_1 + C_L R_1 R_L g_m + C_L R_L)}} (C_1 R_1 + C_L R_1 R_L g_m + C_L R_L)}{C_1 R_1 R_L + L_L R_1 g_m + L_L}$$

$$\omega_0: \sqrt{\frac{R_1 (R_1 g_m + 1)}{L_L (C_1 R_1 + C_L R_1 R_L g_m + C_L R_L)}}$$

$$\text{Bandwidth: } \frac{C_1 R_1 R_L + L_L R_1 g_m + L_L}{L_L (C_1 R_1 + C_L R_1 R_L g_m + C_L R_L)}$$

**Filter 39****Filter Type:** GE

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s): \frac{R_1 g_m (C_L L_L R_L s^2 + L_L s + R_L)}{(C_1 L_L s^2 + 1)(C_1 R_1 s + R_1 g_m + 1)}$$

$$\mathbf{Q}: \frac{C_L L_L \sqrt{\frac{1}{C_1^2 L_L^2}} (R_1 g_m + 1)}{C_1 R_1}$$

$$\omega_0: \sqrt{\frac{1}{C_L L_L}}$$

$$\text{Bandwidth: } \frac{C_1 R_1}{C_L L_L (R_1 g_m + 1)}$$

$$\mathbf{Qz}: C_L R_L \sqrt{\frac{1}{C_L L_L}}$$

**Filter 40**

Invalid filter

$$Z(s): \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

**Filter 41**

Invalid filter

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$$

**Filter 42**

Invalid filter

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$$

**Filter 43****Filter Type:** Invalid011

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s): \frac{R_1 g_m (C_1 R_1 s + 1)}{(C_L R_L s + 1)(C_1 R_1 g_m + C_1 s + g_m)}$$

$$\mathbf{Q}: \frac{C_1 C_L R_L \sqrt{\frac{1}{C_1^2 C_L^2 R_L^2 (R_1 g_m + 1)}} (R_1 g_m + 1)}{C_1 R_1 g_m + C_1 s + C_L R_L g_m}$$

$$\omega_0: \sqrt{\frac{R_1 g_m}{C_1 C_L R_L (R_1 g_m + 1)}}$$

$$\text{Bandwidth: } \frac{C_1 R_1 g_m + C_1 + C_L R_L g_m}{C_1 C_L R_L (R_1 g_m + 1)}$$

**Filter 44**

Invalid filter

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$$

**Filter 45**

Invalid filter

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$$

**Filter 46****Filter Type:** Invalid110

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s): \frac{L_L g_m s (C_1 R_1 s + 1)}{(C_1 L_L s^2 + 1)(C_1 R_1 g_m s + C_1 s + g_m)}$$

$$\mathbf{Q}: \frac{C_L L_L g_m \sqrt{\frac{1}{C_1^2 L_L^2}}}{C_1 (R_1 g_m + 1)}$$

$$\omega_0: \sqrt{\frac{1}{C_L L_L}}$$

$$\text{Bandwidth: } \frac{C_1 (R_1 g_m + 1)}{C_L L_L g_m}$$

**Filter 47**

Invalid filter

$$Z(s): \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$$

**Filter 48**

**Filter Type:** Invalid110

$$Z(s)\colon \left(R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$
$$H(s)\colon \frac{L_LR_Lg_m s(C_1R_1s+1)}{(C_1R_1g_ms^2+C_1s+g_m)(C_LL_LR_Ls^2+L_Ls+R_L)}$$
$$Q\colon \frac{L_L\sqrt{\frac{R_Lg_m}{L_L(C_1R_1g_ms+C_1+C_LR_Lg_m)}}(C_1R_1g_m+C_1+C_LR_Lg_m)}{C_1R_LR_Lg_m+C_1R_L+L_Lg_m}$$
$$\omega_0\colon \sqrt{\frac{R_Lg_m}{L_L(C_1R_1g_m+C_1+C_LR_Lg_m)}}$$

**Bandwidth:**  $\frac{C_1R_LR_Lg_m+C_1R_L+L_Lg_m}{L_L(C_1R_1g_m+C_1+C_LR_Lg_m)}$

**Filter 49**

Invalid filter

$$Z(s)\colon \left(R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

**Filter 50**

Invalid filter

$$Z(s)\colon \left(R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_LL_L}\right)}{L_Ls+R_L+\frac{1}{C_LL_L}}\right)$$

**Filter 51**

**Filter Type:** BS

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L\right)$$

$$H(s)\colon \frac{R_Lg_m(C_1L_1s^2+1)}{C_1L_1g_ms^2+C_1s+g_m}$$

$$Q\colon L_1g_m\sqrt{\frac{1}{C_1^2L_1^2}}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1L_1}}$$

**Bandwidth:**  $\frac{1}{L_1g_m}$

**Filter 52**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$$

**Filter 53**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$$

**Filter 54**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$$

**Filter 55**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$$

**Filter 56**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$$

**Filter 57**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$$

**Filter 58**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$

**Filter 59**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

**Filter 60**

Invalid filter

$$Z(s)\colon \left(L_1s+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_LL_L}\right)}{L_Ls+R_L+\frac{1}{C_LL_L}}\right)$$

**Filter 61**

**Filter Type:** BP

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L\right)$$

$$H(s)\colon \frac{L_LR_Lg_ms}{C_1L_1s^2+L_1g_ms+1}$$

$$Q\colon \frac{C_1\sqrt{C_1^2L_1^2}}{g_m}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1L_1}}$$

**Bandwidth:**  $\frac{g_m}{C_1}$

**Filter 62**

**Filter Type:** LP

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$$

$$H(s)\colon \frac{L_Lg_m}{C_1(C_1C_1L_1s^2+L_1g_ms+1)}$$

$$Q\colon \frac{C_1\sqrt{C_1^2L_1^2}}{g_m}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1L_1}}$$

**Bandwidth:**  $\frac{g_m}{C_1}$

**Filter 63**

**Filter Type:** BP

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$$

$$H(s)\colon \frac{L_LR_Lg_ms}{(C_1R_Ls+1)(C_1L_1s^2+L_1g_ms+1)}$$

$$Q\colon \frac{L_L\sqrt{\frac{1}{L_1(C_1+C_LR_Lg_m)}}(C_1+C_LR_Lg_m)}{C_LR_L+L_1g_m}$$

$$\omega_0\colon \sqrt{\frac{1}{L_1(C_1+C_LR_Lg_m)}}$$

**Bandwidth:**  $\frac{C_LR_L+L_1g_m}{L_1(C_1+C_LR_Lg_m)}$

**Filter 64**

**Filter Type:** Invalid011

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$$

$$H(s)\colon \frac{L_Lg_m(C_LR_Ls+1)}{C_L(C_1L_1s^2+L_1g_ms+1)}$$

$$\mathbf{Q}\colon \frac{C_1\sqrt{\frac{1}{C_1^2L_1^2}}}{g_m}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1^2L_1}}$$

$$\mathbf{Bandwidth}\colon \frac{g_m}{C_1}$$

**Filter 65**

Invalid filter

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$$

**Filter 66**

**Filter Type:** HP

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$$

$$H(s)\colon \frac{L_1L_Lg_ms^2}{(C_1L_1s^2+1)(C_1L_1s^2+L_1g_ms+1)}$$

$$\mathbf{Q}\colon \frac{C_1L_1+C_LL_L\sqrt{\frac{1}{C_1^2L_1^2+C_L^2L_L^2}}}{L_1g_m}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1L_1+C_LL_L}}$$

$$\mathbf{Bandwidth}\colon \frac{L_1g_m}{C_1L_1+C_LL_L}$$

**Filter 67**

Invalid filter

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$$

**Filter 68**

**Filter Type:** HP

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$

$$H(s)\colon \frac{L_1L_LR_Lg_ms^2}{(C_1L_1s^2+L_1g_ms+1)(C_LL_LR_Ls^2+L_Ls+R_L)}$$

$$\mathbf{Q}\colon \frac{\sqrt{\frac{R_L}{C_1L_1R_L+C_LL_LR_L+L_1L_Lg_m}}(C_1L_1R_L+C_LL_LR_L+L_1L_Lg_m)}{L_1R_Lg_m+L_L}$$

$$\omega_0\colon \sqrt{\frac{R_L}{C_1L_1R_L+C_LL_LR_L+L_1L_Lg_m}}$$

$$\mathbf{Bandwidth}\colon \frac{L_1R_Lg_m+L_L}{C_1L_1R_L+C_LL_LR_L+L_1L_Lg_m}$$

**Filter 69**

Invalid filter

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

**Filter 70**

Invalid filter

$$Z(s)\colon \left(\frac{L_Ls}{C_1L_1s^2+1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$$

**Filter 71**

**Filter Type:** GE

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L\right)$$

$$H(s)\colon \frac{R_Lg_m(C_1L_1s^2+C_1R_1s+1)}{C_1L_1g_ms^2+C_1R_1g_ms+C_1s+g_m}$$

$$\mathbf{Q}\colon \frac{L_1g_m\sqrt{\frac{1}{C_1^2L_1^2}}}{R_1g_m+1}$$

$$\omega_0\colon \sqrt{\frac{1}{C_1L_1}}$$

$$\mathbf{Bandwidth}\colon \frac{R_1g_m+1}{L_1g_m}$$

$$\mathbf{Qz}\colon \frac{L_1\sqrt{\frac{1}{C_1^2L_1^2}}}{R_1}$$

**Filter 72**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$$

**Filter 73**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$$

**Filter 74**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$$

**Filter 75**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$$

**Filter 76**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$$

**Filter 77**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$$

**Filter 78**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$$

**Filter 79**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$$

**Filter 80**

Invalid filter

$$Z(s)\colon \left(L_1s+R_1+\frac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$$

#### Filter 81

**Filter Type:** BP

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, R_L \right)$$

$$H(s): \frac{L_1R_1R_Lg_m s}{C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1}$$

$$\mathbf{Q:} \frac{C_1R_1\sqrt{\frac{C_1L_1}{C_1L_1}}}{R_1g_m+1}$$

$$\omega_0: \sqrt{\frac{1}{C_1L_1}}$$

$$\mathbf{Bandwidth:} \frac{R_1g_m+1}{C_1R_1}$$

#### Filter 82

**Filter Type:** LP

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{1}{C_Ls} \right)$$

$$H(s): \frac{L_1R_1R_Lg_m s}{C_L(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

$$\mathbf{Q:} \frac{C_1R_1\sqrt{\frac{C_1L_1}{C_1L_1}}}{R_1g_m+1}$$

$$\omega_0: \sqrt{\frac{1}{C_1L_1}}$$

$$\mathbf{Bandwidth:} \frac{R_1g_m+1}{C_1R_1}$$

#### Filter 83

**Filter Type:** BP

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{R_L}{C_LR_Ls+1} \right)$$

$$H(s): \frac{L_1R_1R_Lg_ms}{(C_1R_Ls+1)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

$$\mathbf{Q:} \frac{L_1\sqrt{\frac{R_1}{L_1(C_1R_1+C_LR_1R_Lg_m+C_LR_L)}}(C_1R_1+C_LR_1R_Lg_m+C_LR_L)}{C_LR_LR_L+L_1R_1g_m+L_1}$$

$$\omega_0: \sqrt{\frac{R_1}{L_1(C_1R_1+C_LR_1R_Lg_m+C_LR_L)}}$$

$$\mathbf{Bandwidth:} \frac{C_LR_LR_L+L_1R_1g_m+L_1}{L_1(C_1R_1+C_LR_1R_Lg_m+C_LR_L)}$$

#### Filter 84

**Filter Type:** Invalid011

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_Ls} \right)$$

$$H(s): \frac{L_1R_1g_m(C_LR_Ls+1)}{C_L(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

$$\mathbf{Q:} \frac{C_1R_1\sqrt{\frac{C_1L_1}{C_1L_1}}}{R_1g_m+1}$$

$$\omega_0: \sqrt{\frac{1}{C_1L_1}}$$

$$\mathbf{Bandwidth:} \frac{R_1g_m+1}{C_1R_1}$$

#### Filter 85

Invalid filter

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, L_Ls + \frac{1}{C_Ls} \right)$$

#### Filter 86

**Filter Type:** HP

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{L_Ls}{C_LR_Ls^2+1} \right)$$

$$H(s): \frac{L_1L_LR_1g_ms^2}{(C_LR_Ls^2+1)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

$$\mathbf{Q:} \frac{R_1(C_1L_1+C_LL_L)\sqrt{\frac{C_1L_1+L_LR_L}{C_1L_1+L_LR_L}}}{L_1(R_1g_m+1)}$$

$$\omega_0: \sqrt{\frac{1}{C_1L_1+C_LL_L}}$$

$$\mathbf{Bandwidth:} \frac{L_1(R_1g_m+1)}{R_1(C_1L_1+C_LL_L)}$$

#### Filter 87

Invalid filter

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$$

#### Filter 88

**Filter Type:** HP

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{1}{C_Ls + \frac{1}{R_L + \frac{1}{L_Ls}}} \right)$$

$$H(s): \frac{L_1L_LR_1R_Lg_ms^2}{(C_LR_LR_Ls^2+L_Ls+R_L)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

$$\mathbf{Q:} \frac{\sqrt{\frac{R_1R_L}{C_1L_1R_1R_L+C_LR_LR_Lg_m+L_1R_1g_m+L_1L_L}}(C_1L_1R_1R_L+C_LR_LR_1R_L+L_1L_LR_1g_m+L_1L_L)}{L_1R_1R_Lg_m+L_1R_LR_1}$$

$$\omega_0: \sqrt{\frac{R_1R_L}{C_1L_1R_1R_L+C_LR_LR_Lg_m+L_1R_1g_m+L_1L_L}}$$

$$\mathbf{Bandwidth:} \frac{L_1R_1R_Lg_m+L_1R_L+L_LR_1}{C_1L_1R_1R_L+C_LL_LR_1R_L+L_1L_LR_1g_m+L_1L_L}$$

#### Filter 89

Invalid filter

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{L_Ls}{C_LR_Ls^2+1} + R_L \right)$$

#### Filter 90

Invalid filter

$$Z(s): \left( \frac{1}{C_1s + \frac{1}{R_1 + \frac{1}{L_1s}}}, \infty, \infty, \infty, \infty, \frac{R_L(L_Ls + \frac{1}{C_Ls})}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$$

#### Filter 91

**Filter Type:** GE

$$Z(s): \left( \frac{L_Ls}{C_1L_1s^2+1} + R_1, \infty, \infty, \infty, \infty, R_L \right)$$

$$H(s): \frac{R_Lg_m(C_1L_1R_1s^2+L_1s+R_1)}{C_1L_1R_1g_ms^2+C_1L_1s^2+L_1g_ms+R_1g_m+1}$$

$$\mathbf{Q:} \frac{C_1\sqrt{\frac{C_1L_1}{C_1L_1}}(R_1g_m+1)}{g_m}$$

$$\omega_0: \sqrt{\frac{1}{C_1L_1}}$$

$$\mathbf{Bandwidth:} \frac{g_m}{C_1(R_1g_m+1)}$$

$$\mathbf{Qz:} \ C_1R_1\sqrt{\frac{1}{C_1L_1}}$$

#### Filter 92

Invalid filter

$$Z(s): \left( \frac{L_Ls}{C_1L_1s^2+1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{C_Ls} \right)$$

#### Filter 93

Invalid filter

$$Z(s): \left( \frac{L_Ls}{C_1L_1s^2+1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_LR_Ls+1} \right)$$

**Filter 94**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

**Filter 95**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

**Filter 96**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

**Filter 97**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

**Filter 98**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{\frac{1}{R_L} + \frac{1}{L_L s}} \right)$

**Filter 99**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

**Filter 100**

Invalid filter  
 $Z(s): \left( \frac{L_L s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L \left( L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

**Filter 101**

**Filter Type:** BS  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, R_L \right)$

$H(s): \frac{R_1 R_L g_m (C_1 L_1 s^2 + 1)}{C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1}$

**Q:**  $\frac{L_1 \sqrt{\frac{1}{C_1 L_1}} (R_1 g_m + 1)}{R_1}$

$\omega_0: \sqrt{\frac{1}{C_1 L_1}}$   
**Bandwidth:**  $\frac{R_1}{L_1 (R_1 g_m + 1)}$

**Filter 102**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

**Filter 103**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

**Filter 104**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

**Filter 105**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

**Filter 106**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

**Filter 107**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

**Filter 108**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + R_L + \frac{1}{L_L s}} \right)$

**Filter 109**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

**Filter 110**

Invalid filter  
 $Z(s): \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L \left( L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$