Resistive Tunable Filter

SR series filters are small resistor tunable filters in single-inline package (SIP).
An easy setting of cutoff (center) frequency is assured with the external resistors.
The abundance of filter types extends the range of choice:
- SR-4BL1/2/3: 4-pole Butterworth low pass
- SR-4FL1/2/3: 4-pole Elliptic low pass
- SR-4BH1/2: 4-pole Butterworth high pass
- SR-4FH1/2: 4-pole Elliptic high pass
- SR-2BLH1/2/3: 2-pole Butterworth low/high pass
- SR-1BP1/2: 1-pole pair band pass
- SR-2BP1/2: 2-pole pair band pass
- SR-2BE1/2: 2-pole pair band elimination

### Table: Resistor Tunable Filter SR-4BL/4FL SR-4BH/4FH SR-2BLH SR-1BP/2BP SR-2BE

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<td>Elliptic Low pass</td>
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<td>1-pole pair</td>
<td>2-pole pair</td>
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### Absolute Maximum Ratings

- **Supply voltage (±Vs)**: ±18 V
- **Input voltage**: ±Vs

### Cut-off (fc, -3 dB) / Center (f0) Frequency Characteristics

- **Type 1**: 40 Hz to 1.6 kHz
- **Type 2**: 400 Hz to 20 kHz
- **Type 3**: 5 kHz to 100 kHz

### Pass-band characteristics

- **Gain**: 0 ±0.3 dB, 0 ±1 dB
- **Ripple**: 0.28 dB p-p (typ.)
- **Upper limit freq. (small signal)**: 50 kHz (±1 dB), 100 kHz (±1 dB, HPF)

### Attenuation characteristics

- **Rolloff**: 12 dB/oct, 42 dB/oct eq.
- **Characteristics (1 kHz or 2 kHz)**: 24 dB (typ.), 55 dB (typ.), 12 dB (typ.), 17.5 dB (typ.), 30 dB (typ.)
- **Minimum attenuation**: 46 dB (typ.), 46 dB (typ.)

### Input characteristics

- **Input impedance**: Min. 50 kΩ
- **Max. input**: ±10 V
- **Voltage (linear)**: ±5 V, ±10 V for 4BL3/4FL3/2BLH3, ±100 kHz for other filters

### Output characteristics

- **Output impedance**: Max. 100 Ω
- **Max. output voltage**: ±10 V (Max. 100 kHz for 4BL3/4FL3/2BLH3, Max. 10 kHz for other filters)
- **Load resistance**: Min. 10 kΩ
- **Noise**: Max. 140 μVrms (10kHz to 500 kHz)

### Others

- **Dimensions**: 51.5 x 14 mm
- **S20 type, 5.5 mm in thickness for Type 3 and 2BE filters, 4 mm in thickness for other filters

Note: The specifications are applied unless otherwise specified: ±18 V, ±5 V, ±10 V, ±15 V, ±100 kHz.
RESISTOR TUNABLE FILTER

Basic connection diagram

SR-4FL
SR-2BP SR-2BE

SR-4FH
SR-2BLH

Offset voltage adjustment

C: 0.1 uF (par)

SR-1BP

SR-4FH   SR-2BP    SR-2BE
SR-4FL    SR-2BLH

Block diagram

SR-4BL

SR-4FL

SR-4FH

SR-2BLH

SR-2BP

SR-2BE

Cut-off (center) frequency setting

• Equation of external resistor $R'$
  
  Type 1  $R' = \frac{159 \times 10^4}{(f_0 \text{ or } f_c)}$ [kΩ]
  
  Types 2&3  $R' = \frac{159}{(f_0 \text{ or } f_c)}$ [kΩ]
  
  • Equation of external resistor $R'$ for expansion of lower cut-off (center) frequency

  An external capacitor ($C_i'$) is used.

  Type 1  $R' = \frac{159}{(C_i' + 0.01) \times (f_0 \text{ or } f_c)}$ [kΩ]
  
  Types 2&3  $R' = \frac{159}{(C_i' + 0.001) \times (f_0 \text{ or } f_c)}$ [kΩ]

Note: Units: $f_c$ or $f_0$ in Hz, $C_i'$ in µF

$R$: 8k to 40kΩ, 1.5k to 40kΩ for Type 3 filters

Be sure to use a resistor and capacitor with tolerance of 1%.
Characteristics

4BL/4BH/2BLH

1BP/2BP

4FL

1BP/2BP (Magnified view)

4FH

2BE
• Cut-off frequency setting (ripple: 0.53dB)
  External resistor (R₁ to R₄) is derived from the following equation.
  \[
  \begin{align*}
  R₁ &= R₂ = R₃ = R₄ = R₂\times 1.014 \\
  R₅ &= 1.797R₄ \\
  R₆ &= 0.4788R₄ \\
  \end{align*}
  \]
  Type 1: \( R₅ = \frac{159 \times 10^3}{f_c} \) (kΩ)
  Type 2: \( R₆ = \frac{159 \times 10^3}{f_c} \) (kΩ)

• Equation of external resistor for expansion of lower cut-off frequency
  \[
  \begin{align*}
  \text{Type 1: } R_r &= \frac{159}{(C_f + 0.01) \times f_c} \\
  \text{Type 2: } R_r &= \frac{159}{(C_f + 0.001) \times f_c} \\
  \end{align*}
  \]
  Note: \( f_c \) in Hz, \( C_f \) in \( \mu F \)

• Cut-off frequency setting
  External resistor (R₁ to R₈) is derived from the following equation.
  \[
  \begin{align*}
  R₁ &= R₂ = R₃ = R₄ = R₂\times 1.014 \\
  R₅ &= 1.801R₄ \\
  R₆ &= 1.221R₄ \\
  R₇ &= 1.797R₄ \\
  R₈ &= 0.4788R₄ \\
  \end{align*}
  \]
  Type 1: \( R₅ = \frac{159 \times 10^3}{f_c} \) (kΩ)
  Type 2: \( R₆ = \frac{159 \times 10^3}{f_c} \) (kΩ)
  Type 3: \( R₇ = \frac{159 \times 10^3}{f_c} \) (kΩ)
  Type 4: \( R₈ = \frac{159 \times 10^3}{f_c} \) (kΩ)

• Equation of external resistor for expansion of lower cut-off frequency
  \[
  \begin{align*}
  \text{Type 1: } R_r &= \frac{159}{(C_f + 0.01) \times f_c} \\
  \text{Type 2,3: } R_r &= \frac{159}{(C_f + 0.001) \times f_c} \\
  \end{align*}
  \]
  Note: \( f_c \) in Hz, \( C_f \) in \( \mu F \)