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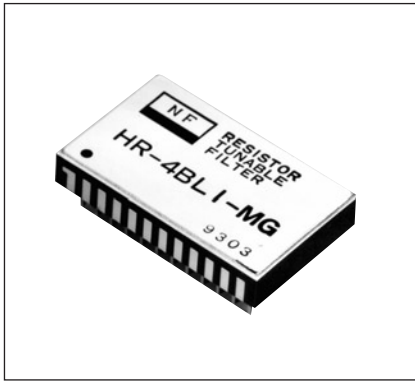E-Mail: info@pewa.de
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Resistor Tunable Filter

HR-4BL HR-4FL HR-4BH HR-4FH HR-2BP

HR series filters are resistor tunable filters that not only realize a wide operating temperature range but ensure high reliability through the adoption of the hermetic seal method and ceramic packaging. An easy setting of cutoff (center) frequency is assured with four external resistors of the same resistance.
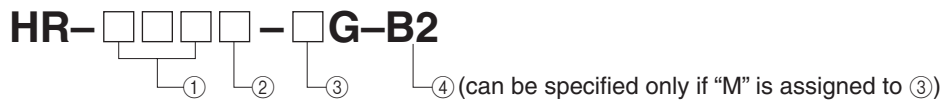
4-pole Butterworth and elliptic low pass and high pass, and 2-pole Butterworth band pass are incorporated into filter characteristics.

The setting range of cutoff (center) frequency falls into two types: Type 1 (10Hz to 1.6kHz) and Type 2 (100Hz to 100kHz (50kHz)).

The operating temperature range is selectable, –40°C to 85°C (most of industrial request) or –55°C to 125°C (MIL-STD).

Screening meets MIL-STD and special reliable tests are available on request.

Model

HR–☐☐☐☐–☐G–B2

① ② ③ ④ (can be specified only if "M" is assigned to ③)

① Filter characteristics
  4BL: 4-pole Butterworth low pass filter
  4FL: 4-pole Elliptic low pass filter
  4BH: 4-pole Butterworth high pass filter
  4FH: 4-pole Elliptic high pass filter
  2BP: 2-pole pair Butterworth band pass filter

② Cutoff (center) frequency setting range
  1: 10Hz to 1.6kHz
  2: 100Hz to 100kHz (50kHz)

③ Operating temperature range
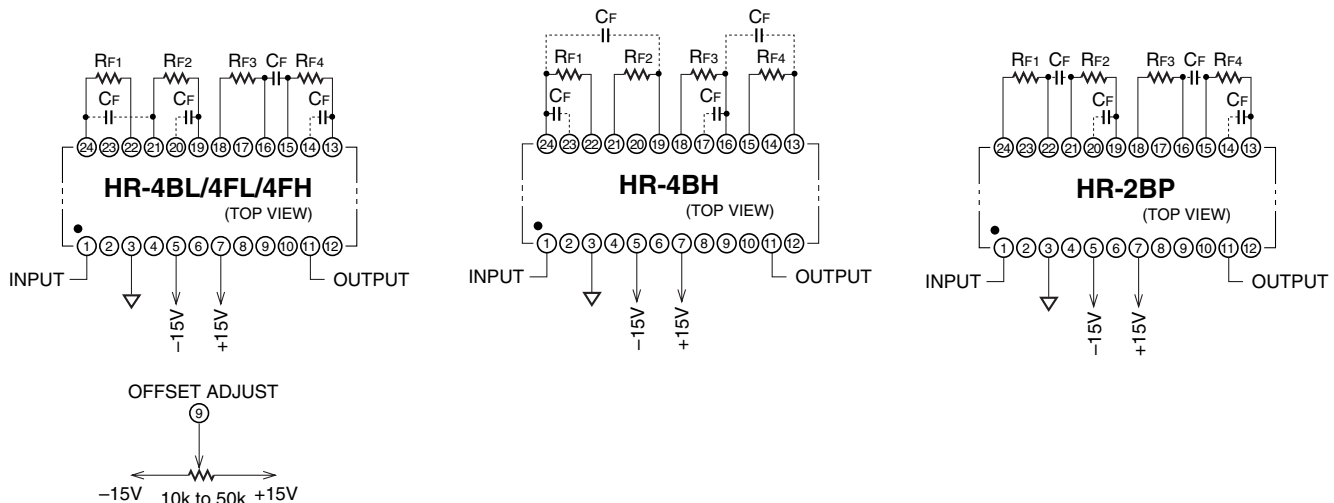 E: –40°C to 85°C
  M: –55°C to 125°C

④ Reliability level
  B2: Conduct screening

Screening

Item	Applicable standard	Product reliability level	
	MIL-STD-883	MG-B2*	MG, EG
Internal visual	2017	○	○
Stabilization bake	1008 Condition C	○	–
Temperature cycling	1010 Condition C	○	○
Constant acceleration	2001 Condition A, in Y1 direction	○	–
Pre burn-in	According to specifications 23°C	○	–
Burn-in	1015 85°C 160H	○	○ (48 hrs)
Final electrical test	Tests at normal, maximum, and minimum operating temperatures according to specifications	○	○ (23°C only)
Seal	1014 Fine & Gross	○	○
External visual	2009	○	○

* Screened if an order for 10 or more filters is received.

Basic connection diagram

HR-4BL/4FL/4FH (TOP VIEW)

HR-4BH (TOP VIEW)

HR-2BP (TOP VIEW)

INPUT   OUTPUT   –15V   +15V

OFFSET ADJUST
⑨
–15V   10k to 50k   +15V

▼Absolute maximum ratings

Supply voltage (±Vs)		±18V
Input voltage		±Vs
Load		2kΩ
Temperature/ range	Operation	HR-XXXX-EG : −40°C to +85°C, HR-XXXX-MG : −55°C to +125°C
	Storage	−65°C to +150°C

* Critical damage to products is resulted from the application of physical stress that exceeds the absolute maximum ratings. Long-term operation at the maximum ratings leads to considerable degradation in device reliability. The absolute maximum ratings are the rating of stress, which has no assurance of device proper performance under the condition that the specified electrical performance range and maximum ratings are violated.

Model	HR-4BL1/2	HR-4FL1/2	HR-4BH1/2	HR-4FH1/2	HR-2BP1/2
Filter characteristics	4-pole Butterworth low pass	4-pole Elliptic low pass	4-pole Butterworth high pass	4-pole Elliptic high pass	2-pole pair Butterworth band pass

▼Cut-off (fc, -3dB)/center (fo) frequency characteristics

Range[*1]	Type 1	10Hz to 1.6kHz	
	Type 2	100Hz to 100kHz	100Hz to 50kHz
Setting method		Connected with external resistors (4 pcs.)	
Accuracy		Max. ±3%	

▼Pass-band characteristic

Gain	fc<20kHz	0±0.3dB		0±0.5dB		0±1dB
	fc≥20kHz	0±0.3dB		0±1dB		0±2dB
Ripple		–	0.28dB$_{P-P}$ typ	–	0.28dB$_{P-P}$ typ	–
Upper limit frequency	Type 1	–	–	100kHz(±1dB)		–
	Type 2	–	–	400kHz(±1dB)		–

▼Attenuation characteristics

Rolloff	24dB/oct	42dB/oct equivalent	24dB/oct	42dB/oct equivalent	12dB/oct BW
Q	–	–	–	–	5±5%
Attenuation characteristics[*2]	24dB typ	55dB typ	24dB typ	55dB typ	35dB typ
Minimum attenuation	–	46dB typ	–	46dB typ	–
High frequency attenuation (up to 1MHz)	Min. 70dB	Min. 60dB	–	–	Min. 60dB

▼Input characteristics

Input voltage range	±10V
Input impedance	Min. 50kΩ

▼Output characteristics

Output voltage range		±10V				
Output impedance		Max. 100Ω				
Load resistance		Min. 10kΩ				
Offset voltage[*3]		Max. ±30mV				
Offset drift		5μV/°C typ	16μV/°C typ	10μV/°C typ	5μV/°C typ	5μV/°C typ
Noise	Type 1	40μVrms typ	90μVrms typ	120μVrms typ	190μVrms typ	50μVrms typ
	Type 2	35μVrms typ	60μVrms typ	100μVrms typ	140μVrms typ	45μVrms typ
Distortion	Type 1	0.004% typ	0.01% typ	0.02% typ	0.02% typ	0.004% typ
	Type 2	0.003% typ	0.005% typ	0.02% typ	0.02% typ	0.002% typ
Slew rate	Type 1	–	–	10V/μs typ	10V/μs typ	–
	Type 2	–	–	25V/μs typ	25V/μs typ	–

▼Others

Supply voltage		±15V				
Supply voltage range	Type 1	±1.5V to ±18V				
	Type 2	±5V to ±18V				
Quiescent current	Type 1	±1.5mA typ	±2mA typ	±1mA typ	±2mA typ	±1.5mA typ
	Type 2	±15mA typ	±20mA typ	±10mA typ	±20mA typ	±15mA typ
Dimensions		20 × 33 × 7mm (lead excluded) (24-pin DIP), KC type				

*1: Expansion of the lower cut-off (center) frequency with the external capacitors (4 pcs.) is enabled.   *2: Attenuation for low pass and band pass: 2fc, for high pass: 1/2fc
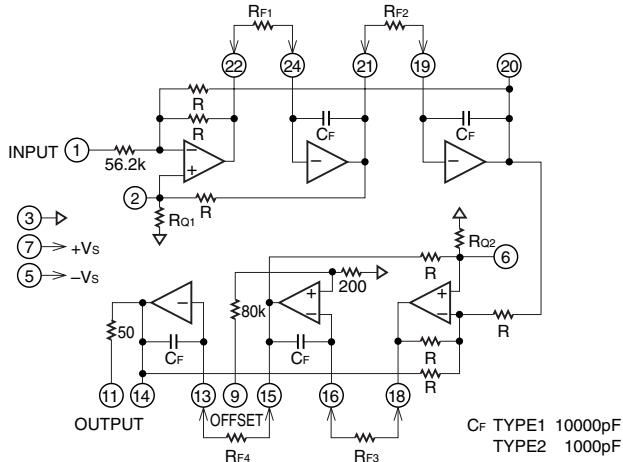*3: Zero adjustment available

■*Multichannel Filter 3314*

Rear panel
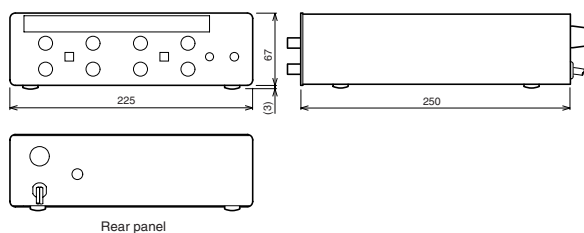
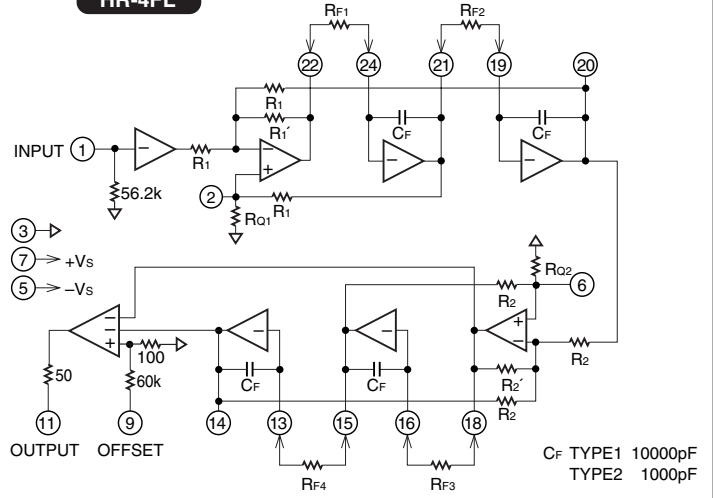This 3314 is capable of storing up to 4 HR filters that is utilized as a desktop-type fixed frequency filter.

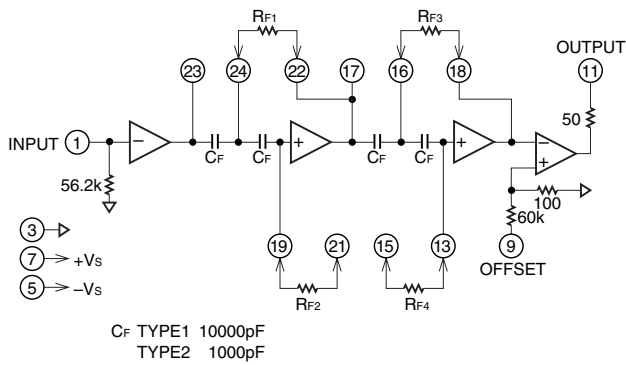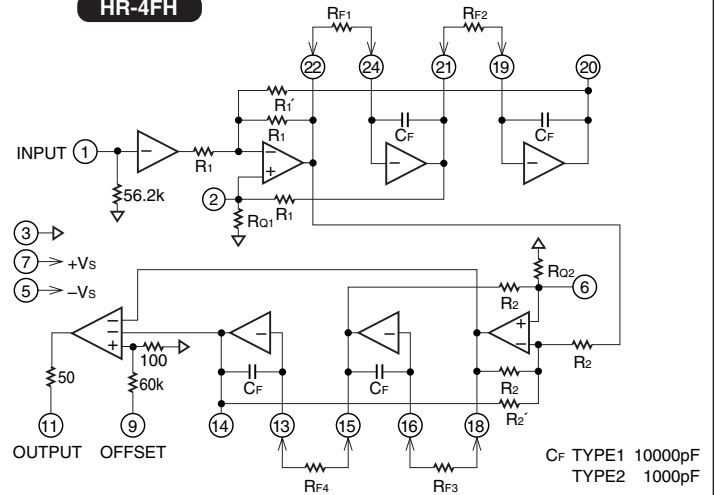| Available filters	All HR filters
Number of channels	Max. 4
	Continuous connection of CH1/2 with CH3/4 available
fc/fo setting	Fixed resistors (2 or 4 pcs.) are soldered to the discrete platform (accessory) and connected to the socket.
Supply voltage	AC100V, ±10%, 48Hz to 62Hz
Dimensions	225(W) × 67(H) × 250(D)mm (protrusion not included)

Filters

Filters

Block diagram

HR-4BL

C_F TYPE1 10000pF
TYPE2 1000pF

HR-4FL

C_F TYPE1 10000pF
TYPE2 1000pF

HR-4BH

C_F TYPE1 10000pF
TYPE2 1000pF

HR-4FH

C_F TYPE1 10000pF
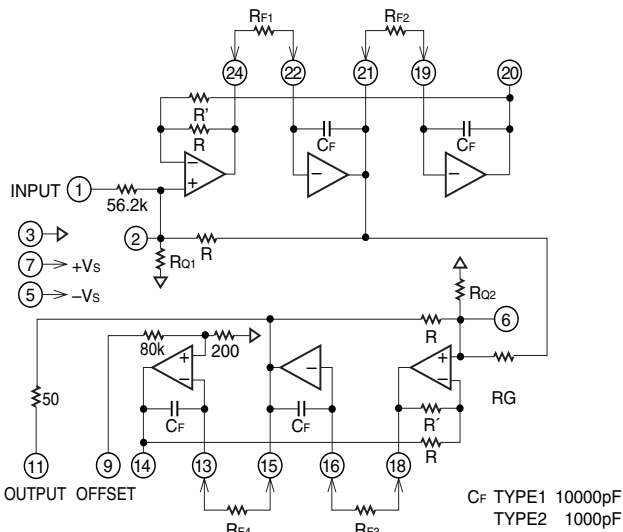TYPE2 1000pF

HR-2BP

C_F TYPE1 10000pF
TYPE2 1000pF

■Cut-off (center) frequency setting

• Equation of external resistor R_F

Type 1 $R_{F1} = R_{F2} = R_{F3} = R_{F4} = R_F$

$$R_F = \frac{15.9 \times 10^3}{fc \text{ or } fo \text{ [Hz]}} \text{ [k}\Omega\text{]}$$

Type 2 $R_{F1} = R_{F2} = R_{F3} = R_{F4} = R_F$

$$R_F = \frac{159 \times 10^3}{fc \text{ or } fo \text{ [Hz]}} \text{ [k}\Omega\text{]}$$

• Equation of external resistor R_F for expansion of the lower frequency with the use of a capacitor (C_F)

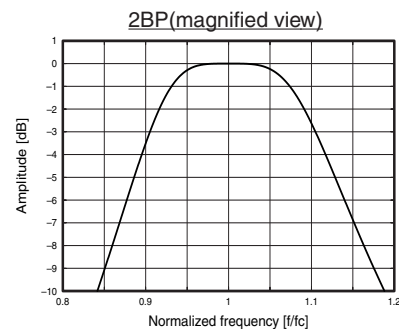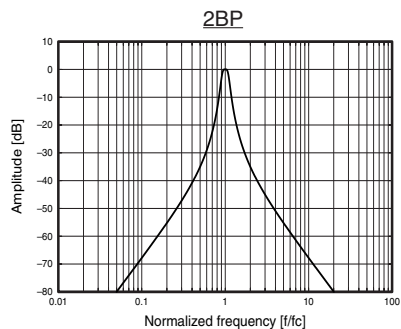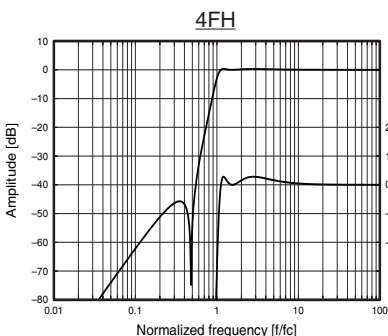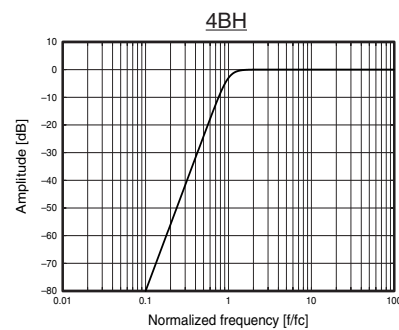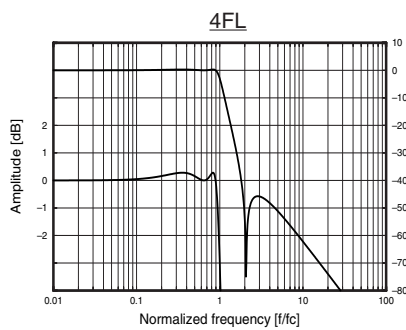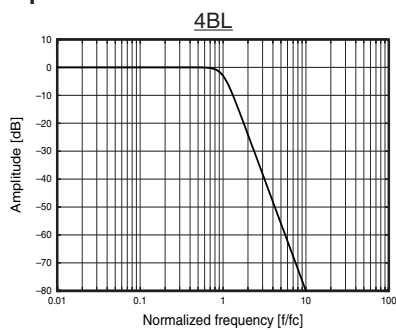Type 1 $R_{F1} = R_{F2} = R_{F3} = R_{F4} = R_F$

$$R_F = \frac{159}{(C_F[\mu F]+0.01) \times fc \text{ or } fo \text{ [Hz]}} \text{ [k}\Omega\text{]}$$

Type 2 $R_{F1} = R_{F2} = R_{F3} = R_{F4} = R_F$

$$R_F = \frac{159}{(C_F[\mu F]+0.001) \times fc \text{ or } fo \text{ [Hz]}} \text{ [k}\Omega\text{]}$$

Characteristics

Amplitude

4BL

Amplitude [dB] vs Normalized frequency [f/fc]

4FL

Amplitude [dB] vs Normalized frequency [f/fc]

4BH

Amplitude [dB] vs Normalized frequency [f/fc]

4FH

Amplitude [dB] vs Normalized frequency [f/fc]

2BP

Amplitude [dB] vs Normalized frequency [f/fc]

2BP(magnified view)

Amplitude [dB] vs Normalized frequency [f/fc]

Temperature

▼Cut-off frequency drift (Type 1: fc = 500Hz, Type 2: fc = 5kHz)　　　　▼Offset voltage drift (Type 1: fc = 500Hz, Type 2: fc = 5kHz)

4BL1
Frequency vs Temperature

4BL2
Frequency vs Temperature

4BL1
Offset voltage (mV) vs Temperature

4BL2
Offset voltage (mV) vs Temperature

4FL1
Frequency vs Temperature

4FL2
Frequency vs Temperature

4FL1
Offset voltage (mV) vs Temperature

4FL2
Offset voltage (mV) vs Temperature

4BH1
Frequency vs Temperature

4BH2
Frequency vs Temperature

4BH1
Offset voltage (mV) vs Temperature

4BH2
Offset voltage (mV) vs Temperature

4FH1
Frequency vs Temperature

4FH2
Frequency vs Temperature

4FH1
Offset voltage (mV) vs Temperature

4FH2
Offset voltage (mV) vs Temperature

2BP1
Frequency vs Temperature

2BP2
Frequency vs Temperature

2BP1
Offset voltage vs Temperature

2BP2
Offset voltage vs Temperature

Filters