

T-64-05

TDK ACTIVE FILTERS

Hybrid IC, HAF series

TDK active filters are designed to provide superior filtering performance for a wide range of applications. Their compact size makes them ideal for high-density applications. These devices employ TDK's high-performance multi-layer ceramic chip capacitor, and use proprietary techniques for implementing filter designs into a hybrid IC. The result is high-performance operation combined with excellent quality and reliability.

The HAF series includes a number of different filter ICs for different applications. This catalog illustrates only a few of the filter types available. For information on additional types, please contact TDK.



FEATURES

- Constructed using TDK's proprietary hybrid IC technique.
- Function trimming provides high accuracy.
- Manufactured according to TDK's comprehensive quality control procedures to ensure high quality and reliability.
- Assembled using selected high-performance ICs.
- TDK's high-quality multi-layer ceramic chip capacitor and alumina substrate provide outstanding performance.

APPLICATIONS

- Digital audio systems
- Video cassette recorders
- Televisions
- Facsimile equipment
- Videotex systems (such as CAPTAIN system*)

General characteristics

Operating temperature range	°C [°F]	0 to +60 [+32 to +140]
Storage temperature range	°C [°F]	-25 to +80 [-13 to +176]
Humidity	% (R.H.)	95 max. (Maximum wet-bulb temperature: 38°C [100.4°F])

Classification and Part No.

Classification	Part No.	Frequency range	Feature
Low pass filters for digital audio systems	HAF0□□□	0 to 22 kHz	Acoustic quality
Band pass filters for 8 mm VCR/ATF	HAF08□□	16.5/46.2 kHz	Compact size and low price
Notch filters for VCR	HGA01□□	37.5/45.0 Hz and other ranges	Rapid notching, NPO temperature characteristics
Modems for videotex (CAPTAIN system*)	HAF09□□	800 to 3,400 Hz	Series items
Facsimile modems	HAF05□□	300 to 3,700 Hz	Series items

*CAPTAIN system: Character And Pattern Telephone Access Information Network System of Nippon Telegraph and Telephone Corporation.

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1 Low Pass Filter (LPF) for Digital Audio System and Audio Modules

FEATURES

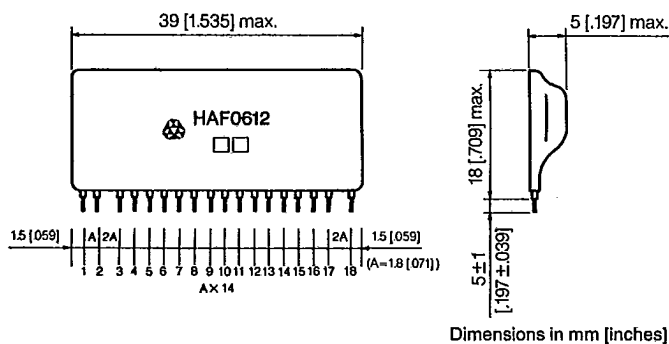
- Design is optimized specifically for highest audio quality.
- Employs copper electrodes and OP amps with copper leads.
- Employs TDK multilayer ceramic chip capacitors selected strictly for audio quality.

Line-up

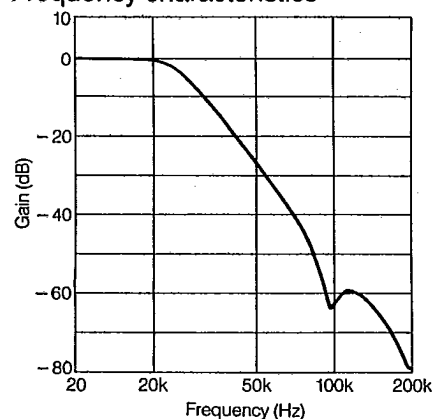
Part No.	Cut-off frequency	Filter orders	Corresponding fs	Channel	Feature
HAF0612	20kHz	3	2, 4	Stereo	An audio module in which all circuits after the D-to-A converter are built-in one.
HAF0257	22kHz	5	2, 4	Stereo	Output in the status where de-emphasis is on. Most appropriate for broadcasting satellite (BS) tuners.
HAF0051	22kHz	5	2, 4	Monaural	Flat group delay time. Compact size and low price.
HAF0019	20kHz	9	1	Monaural	Rapid attenuation

HAF0612 3rd order Stereo Audio Module (HAF0615 is an upgraded version of the HAF0612)

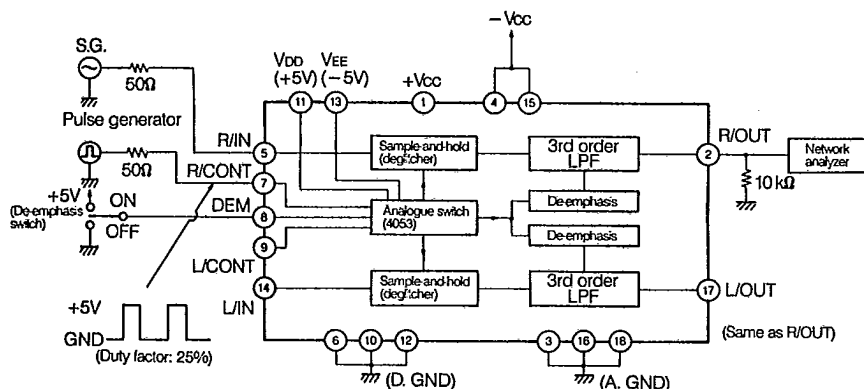
SHAPE AND DIMENSIONS



Frequency characteristics



Block diagram (measuring circuit)



Electrical characteristics (Sampling frequency; 96kHz, Duty factor; 25%, $V_{CC}^* = \pm 12V$, $25 \pm 5^\circ C$ [$77 \pm 9^\circ F$])

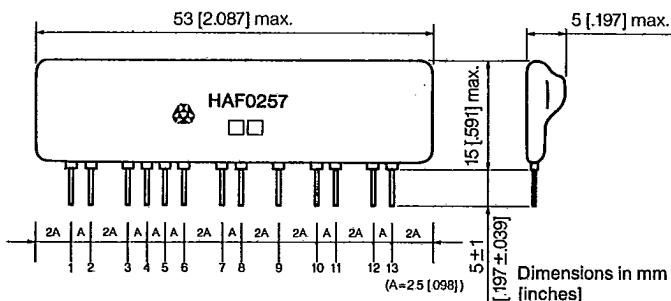
Frequency characteristics	Passband (DC to 20 kHz) $+0.5/-1.0$ dB, De-emphasis: RIAA ON/OFF
Distortion factor (THD+N)	0.003% typ./0.005% max. (Input 1 kHz, 2 V _{rms} , 30 kHz LPF/ON)
Output noise	57 μ V or less (30 kHz LPF/ON)
Crosstalk	-90 dB or less

* HAF0612 operates with $V_{CC} = \pm 5$ V. Single power-supply operation is also available. Please contact TDK.

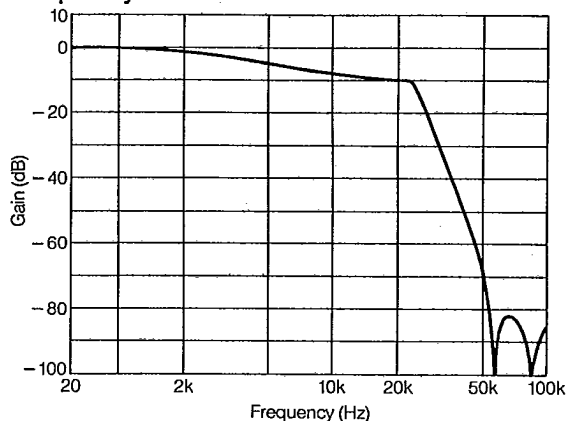
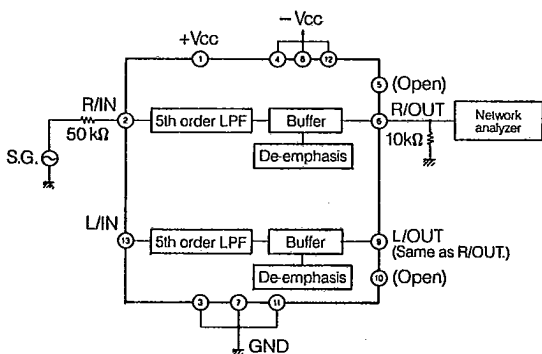
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Block diagram (measuring circuit)



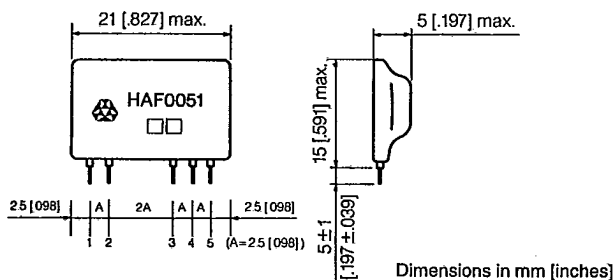
Electrical characteristics (Vcc= ± 12 V, $25 \pm 5^\circ\text{C}$ [$77 \pm 9^\circ\text{F}$])

Ripple	± 0.5 dB (DC to 22 kHz) De-emphasis: RIAA, ON
Attenuation	– 75 dB max. (60 kHz or higher)
Distortion factor (THD+N)*	0.0006% typ./0.003% max.
Insertion loss	0 ± 0.5 dB (100 Hz)
Signal-to-noise ratio*	90 dB or more
Crosstalk	– 90 dB or less (1 kHz)

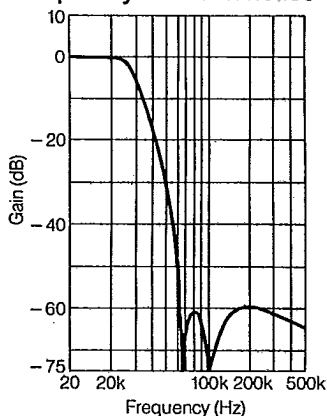
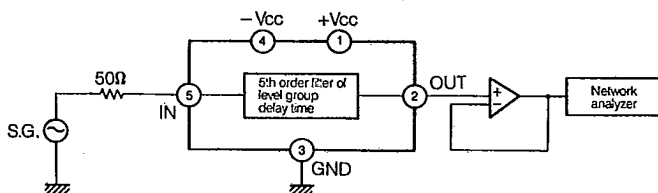
*Input 1 kHz, 2 V_{rms}; 30 kHz LPF/ON

HAF0051 5th order Monaural Active Low-Pass Filter (Flat group delay time)

SHAPE AND DIMENSIONS



Block diagram (measuring circuit)



Electrical characteristics (Vcc= ±15V, 25±5°C [77±9°F])

Ripple	± 0.1 dB typ./ ± 0.5 dB max. (DC to 20 kHz)
Attenuation	55 dB or more (68 kHz or higher)
Distortion factor (THD+N) *	0.002% typ./0.005% max.
Insertion loss	6 ± 0.5 dB (1 kHz)
Signal-to-noise ratio*	100 dB or more
Group delay time deviation	10μs or less (DC to 20 kHz)

*Input 1 kHz, 2 V_{rms}; 30 kHz LPF/ON

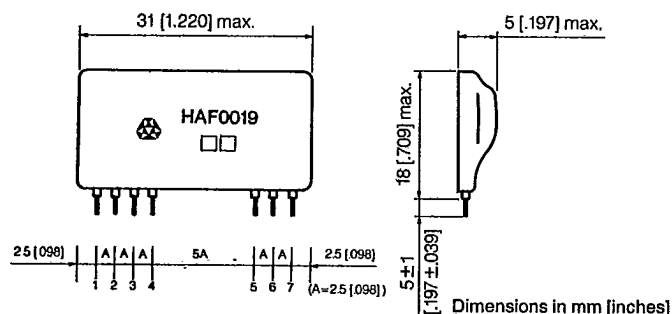
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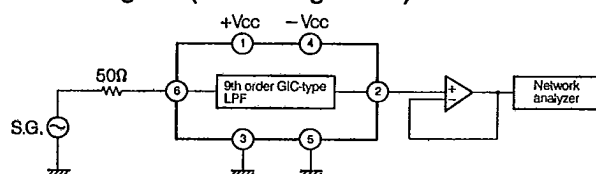
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HAF0019 9th order Monaural Active Low-Pass Filter

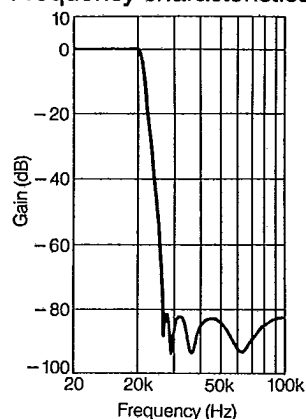
SHAPE AND DIMENSIONS



Block diagram (measuring circuit)



Frequency characteristics



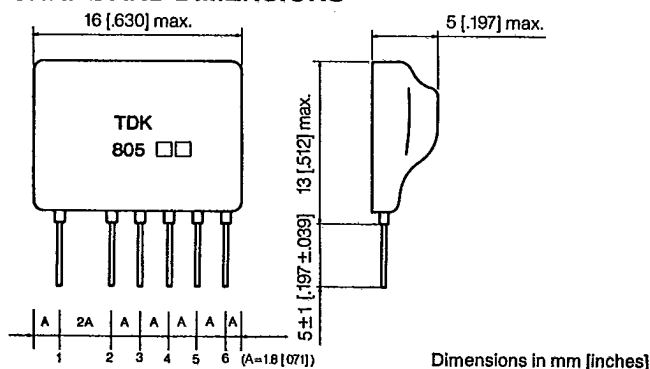
Electrical characteristics (Vcc= ± 15 V, $25 \pm 5^\circ\text{C}$ [$77 \pm 9^\circ\text{F}$])

Ripple	± 0.5 dB (DC to 20 kHz)
Attenuation	78 dB or more (28 kHz or higher)
Distortion factor (THD+N)*	0.003% typ./0.005% max.
Insertion loss	6 ± 0.5 dB (1 kHz)
Signal-to-noise ratio*	96 dB or more

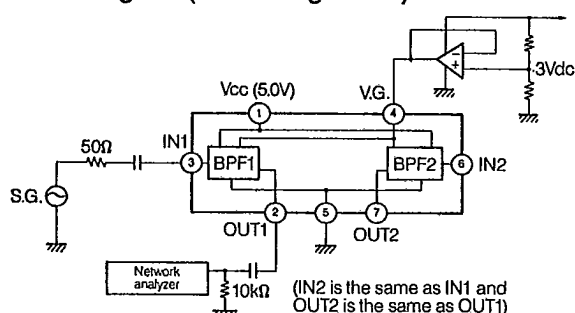
*Input 1 kHz, 2 V_{rms}; 30 kHz LPF/ON

2 Active Band Pass Filter for 8 mm VCR/ATF (HAF0805)

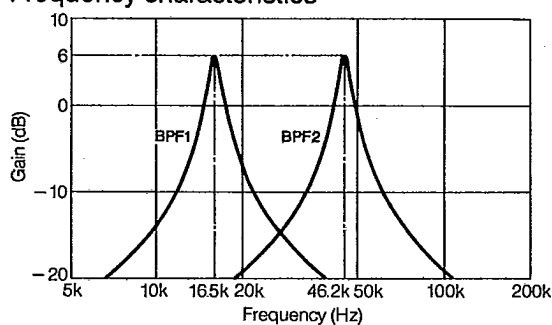
SHAPE AND DIMENSIONS



Block diagram (measuring circuit)



Frequency characteristics



Electrical characteristics (Vcc=+5.0V, 25±5°C [77±9°F])

	OUT1	OUT2	Remarks
Center frequency f_0	16.5 kHz	46.2 kHz	Both NTSC and PAL are available.
Gain at f_0	6 ± 1 dB	6 ± 1 dB	
Q	10 typ.	10 typ.	

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3 Active Notch Filter (CR Module) for VCR Drum (Capstan) Servo Control System

FEATURES

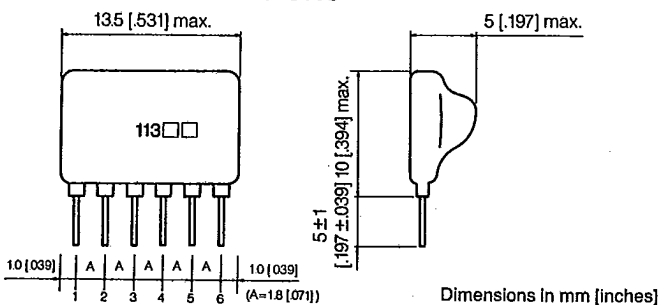
- The latest hybrid construction techniques produce a filter which is small and lightweight.
- High accuracy and excellent temperature characteristics provided by the exclusive use of NP0 chip capacitors.
- TDK's proprietary filter design allows free selection of both center frequency and quality factor (Q).

Electrical characteristics (25 ± 5°C [77 ± 9°F])

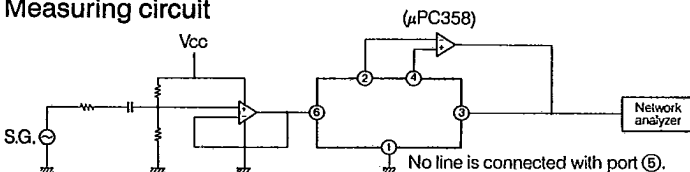
Part No.	Center frequency f_0	Attenuation	Insertion loss	Phase delay	Appliance
HGA00113	704.20 Hz	40 dB min. (at f_0)	1 dB max. (at 0.44 f_0)	12 deg. max. (at 0.44 f_0)	NTSC
HGA00114	741.15 Hz				PAL
HGA00129	450.0 Hz				NTSC
HGA00130	37.5 Hz				PAL

HGA0113 (0114)

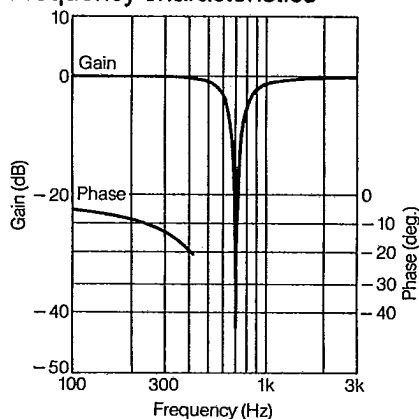
SHAPE AND DIMENSIONS



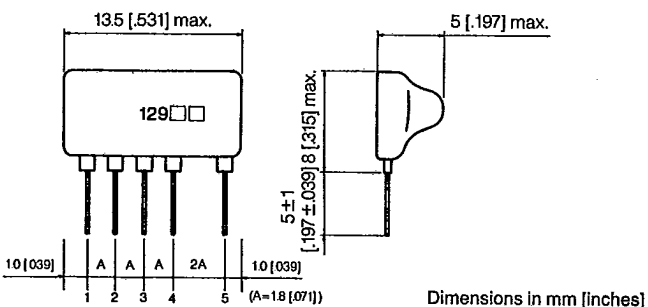
Measuring circuit



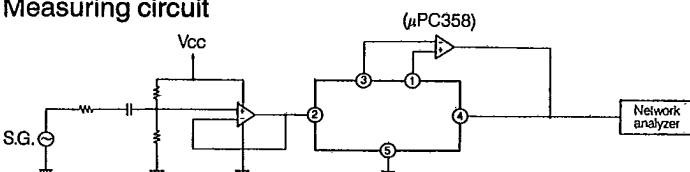
Frequency characteristics

**HGA0129 (0130)**

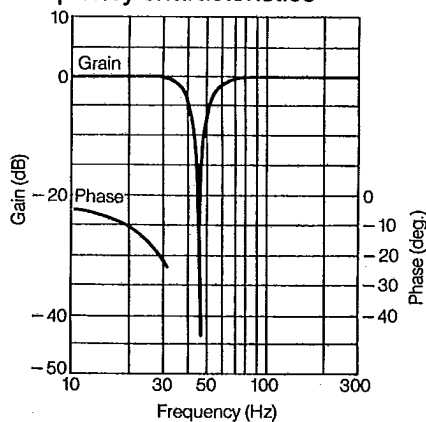
SHAPE AND DIMENSIONS



Measuring circuit



Frequency characteristics



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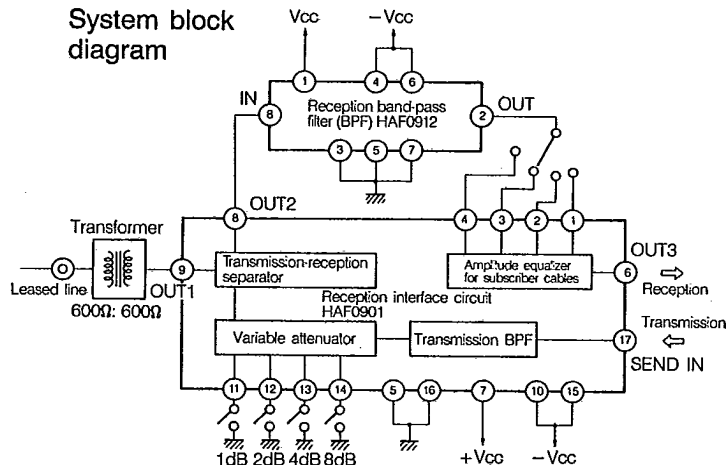
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4 Active Filter Series for Modems in Videotex (HAF0901, HAF0912)

FEATURES

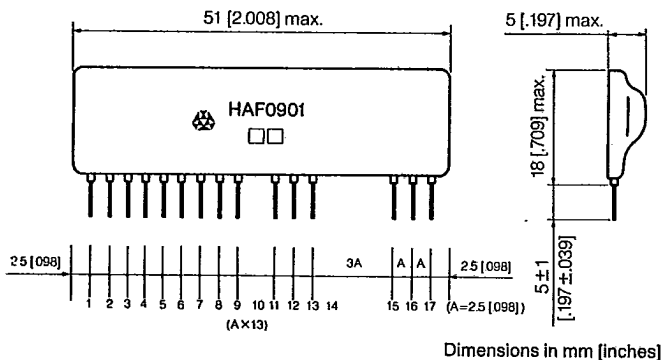
- Provides main functions for a videotex (CAPTAIN system) in two compact hybrid ICs.
- Manufactured using TDK's comprehensive quality control procedures to ensure high quality and reliability.

System block diagram

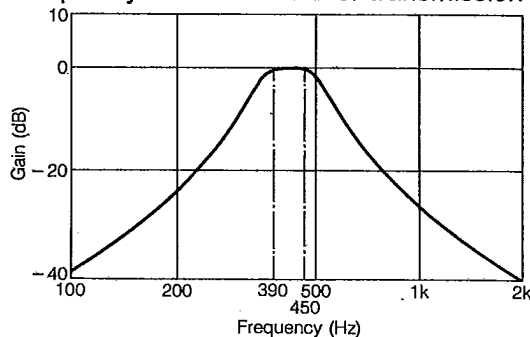
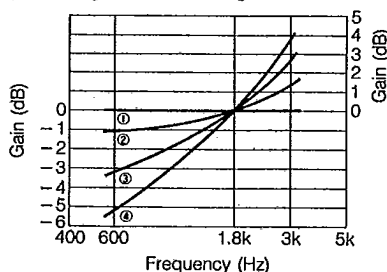


HAF0901 Transmission Interface Circuit

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Frequency characteristics of transmission BPF

Frequency characteristics of cable amplitude equalizer
(Relative gains where the gain at 1800 Hz is assumed to be 0 dB)

Electrical characteristics ($V_{cc} = \pm 12V$, $25 \pm 5^\circ C$ [$77 \pm 9^\circ F$])

Item	Rating
Transmission BPF	0 ± 0.5 dB (at 390, 450 Hz), -20 dB max. (at 200, 1,000 Hz)
Variable attenuator	Variable by 1 dB between 0 and 15 dB
Transmission-reception separator	Receiving: 0 ± 0.5 dB (OUT2/OUT1), Transmitting (Run-around to reception side): -20 dB max. (OUT2/SEND IN)
Cable amplitude equalizer	Four types of equalizers can be switched. (See "Frequency characteristics of amplitude equalizer" above.) Error is ± 1.0 dB in each equalizer.

• Pin ① (OUT 1): Termination of 600Ω . Pins ② and ③ (OUT2, 3): Load resistance of $10\text{ k}\Omega$ or more.

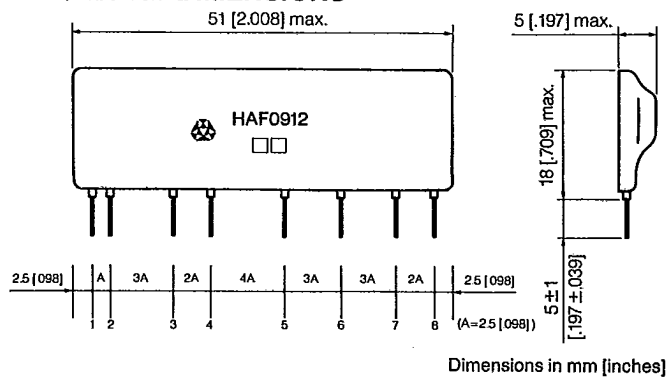
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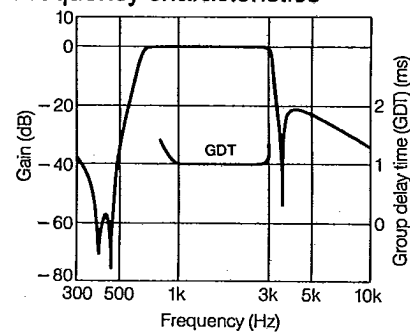
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HAF0912 Reception BPF

SHAPE AND DIMENSIONS



Frequency characteristics



Electrical characteristics ($V_{cc} = \pm 12V$, $25 \pm 5^\circ C$ [$77 \pm 9^\circ F$])

Amplitude	0 ± 0.8 dB (800 to 3,000 Hz)
Attenuation-to-amplitude characteristics	-50 dB max. (390, 450 Hz) -20 dB max. (4 kHz or higher)
Group delay time	1 ± 0.1 max. (1,000 to 2,600 Hz)
Insertion loss	0 ± 0.8 dB (1.8 kHz)

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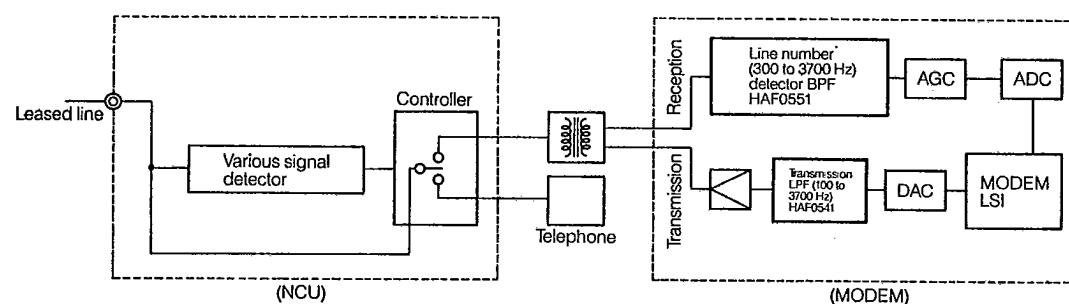
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5 Active Filter Series for Facsimile Equipment

FEATURES

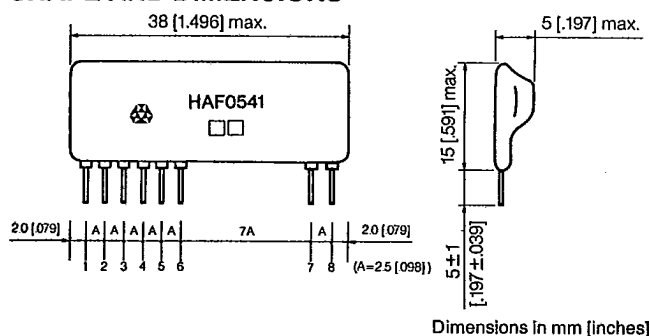
- Provides the functions required for facsimiles, modems, and network control units (NCUs) in compact filters.
- Manufactured using TDK's comprehensive quality control procedures to ensure high quality and reliability.

System block diagram

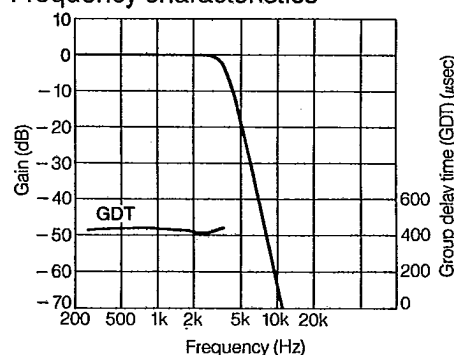


HAF0541

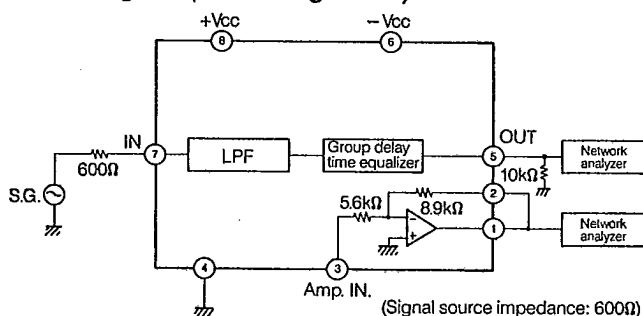
SHAPE AND DIMENSIONS



Frequency characteristics



Block diagram (measuring circuit)



Electrical characteristics ($V_{CC} = \pm 12V$, $25 \pm 5^\circ C$ [$77 \pm 9^\circ F$])

Passband	100 to 3,700 Hz
Ripple	1.0 dB or less (100 to 2 kHz)
Attenuation	55 dB or more (10 kHz or higher)
Group delay time deviation	100 μsec. or less
Insertion loss	0 ± 1.0 dB

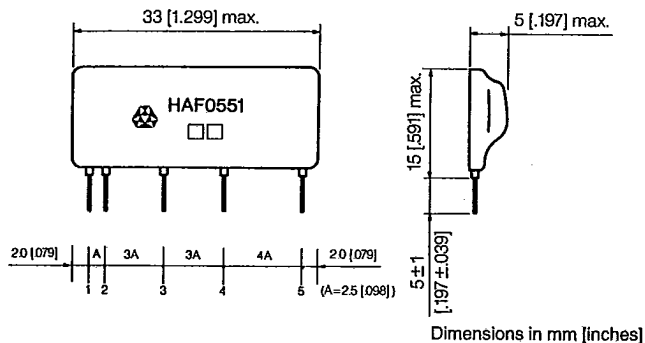
TDK ACTIVE FILTERS

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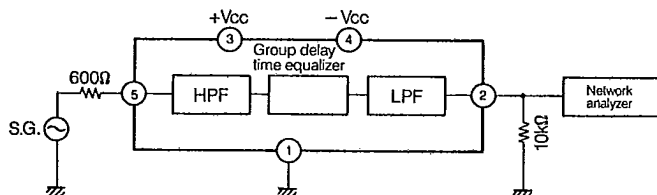
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HAF0551

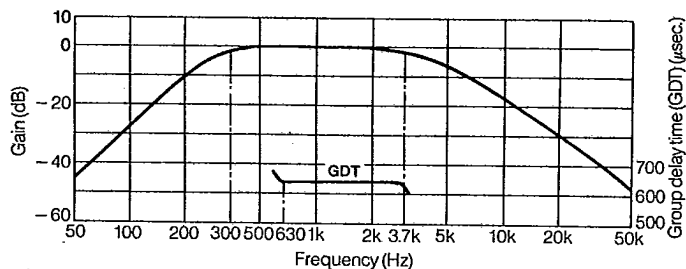
SHAPE AND DIMENSIONS



Block diagram (measuring circuit)



Frequency characteristics



Electrical characteristics ($V_{cc} = \pm 12V$, $25 \pm 5^\circ C$ [$77 \pm 9^\circ F$])

Passband (3 dB or less)	300 to 3,700 Hz
Ripple	0.6 dB or less (700 to 2,000 Hz)
Attenuation	40 dB or more (50 Hz, 50 kHz)
Group delay time deviation	$640 \pm 50 \mu s$ (630 to 2,900 Hz)
Insertion loss	0 ± 1.0 dB (1 kHz)

The export of TDK products is subject to approval by the Japanese government in accordance with the Japanese Foreign Currency Exchange, the Japanese Export Control Law and the Coordinating Committee for Export Control (COCOM).

All specifications are subject to change without notice.