

4th- and 8th-Order Continuous-Time Active Filters

EV Kit General Description

The MAX274 Evaluation Kit (EV Kit) shrinks the time required to design and implement a continuous-time lowpass or bandpass filter by providing a software design tool and a prototyping PC board complete with a MAX274 8th-order, continuous-time filter IC. Starting from your basic filter requirements, Maxim's Filter Design Software calculates filter order, poles, and Qs of classic filter types (Butterworth, Chebyshev, or Bessel), then calculates resistor values required to implement the complete filter. Installing these resistors on the PC board provided and cascading the required number of sections of the MAX274 filter yields a complete filter — ready for testing — eliminating the need for expensive and time-consuming prototyping. The MAX274 PC board layout may be incorporated directly in production PC boards for absolutely consistent results from prototype to production.

EV Kit

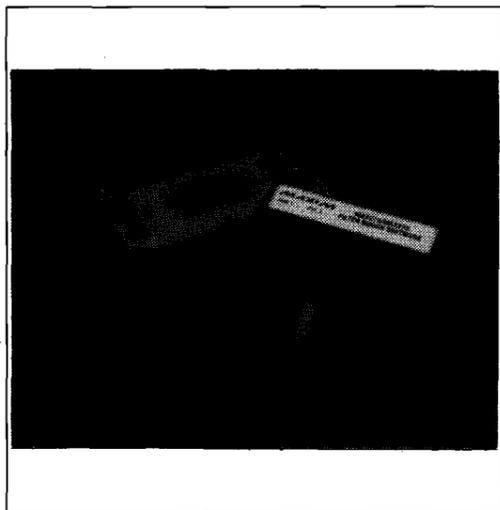


Figure 1. The MAX274 EV kit includes filter design software, PC board with MAX274 IC, and full documentation.

Feature

- ◆ **Allows You to Design and Build Lowpass or Bandpass Filters**
- ◆ **Pole Frequencies (Fo) from 100Hz to 150kHz**
- ◆ **Kit Supports Butterworth, Chebyshev, and Bessel Designs**
- ◆ **Includes Design Software:**
 - Calculates filter order, poles, and Qs from your filter requirements
 - Plots filter responses — gain, phase, and group delay — for inspection BEFORE you build the filter
 - Calculates resistor values needed to build filter
- ◆ **Includes PC Board for Evaluation:**
 - PC board allows you to build filters immediately — simply install proper resistor values on board
 - Build up to 8th-order filters by cascading the four second-order sections — or use sections individually for multiple filters
 - Operates from single +5V or dual 5V supplies

Ordering Information

PART	TEMP. RANGE	BOARD TYPE
MAX274EVKIT	0°C to +70°C	Plastic DIP – Through Hole

Component List

QUANTITY	COMPONENT	SYMBOL
1	MAX274ACNG Filter IC	None
1	MAX274 Filter Circuit PC Board	None
2	BNC Screw-In Connectors	None
3	Banana Jacks	None
4	Standoffs, 4-40 Screws	None
2	10µF/16V Dipped Tantalum Capacitors	C1, C4 or CS1
2	0.1µF Ceramic Capacitors	C2, C3
1	Filter Design Software on 5 1/4" Floppy Disk	None

MAX274/MAX275/Software/EV Kit

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Filter Design Software

NOTE: CHECK FILE "README.DOC" FOR IMPORTANT CHANGES

Installation

You will need an IBM-compatible PC, DOS version 2.0 or later, with a 5 1/4" floppy disk drive, and one of the following video displays: Hercules graphics, CGA, EGA, VGA or compatible. Either a hard drive or an additional floppy drive is also required.

To install the program, insert the floppy into your disk drive and type "A:INSTALL" (or "B:INSTALL"). Follow the instructions on the screen. After installation, type "FILTER" to start the program. Be sure you are in the drive/directory where the software is installed.

Help

After installing the software, print a hard copy of the file FILTER.HLP by entering TYPE FILTER.HLP > PRN from DOS. This collection of help screens serves as the instruction manual for operating the software. Individual help screens may be printed while running the software by pressing F1, then following instructions on the screen.

Assembly Instructions

1. Install BNC connectors and banana jacks as shown in Figure 2. Connect wires from the V+, GND, and V- jacks to the nodes designated V+, GND, and V- on the circuit. Install MAX274 IC as shown (or install an IC socket if desired).
2. Install filter feedback resistors (R1A-R4A, R1B-R4B, R1C-R4C, R1D-R4D). The values of these resistors depend on the particular filter being built, and can be calculated from the data sheet or with the aid of Maxim's Filter Design Software. All resistors except RS1 and RS2 should be either carbon or metal-film type (not wire-wound).

If using resistor T-networks (described in the *High-Value Resistor Transformation* section of the MAX274 data sheet — denoted as R5_ - R10_ in the filter software), perform the following:

On the PC board, scratch off the green soldermask from the ground trace (Figure 2). Where required, substitute each normal resistor connection (R2, R3, or R4) with three T-network resistors on the underside of the board, using jumper wire to connect the T-network ground connection with the ground trace on the PC board (Figure 3).

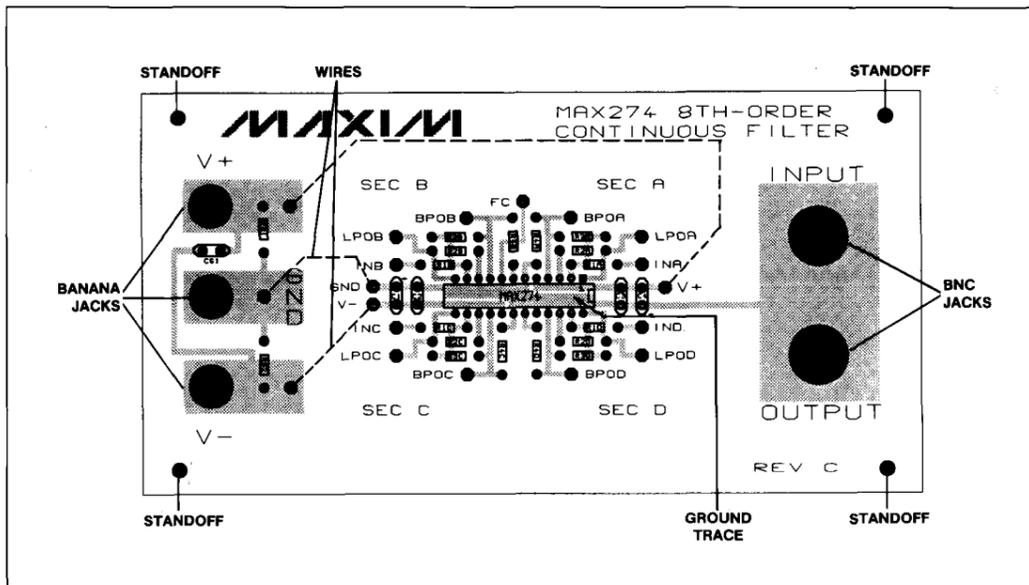


Figure 2. MAX274 EV Kit Component Placement Diagram

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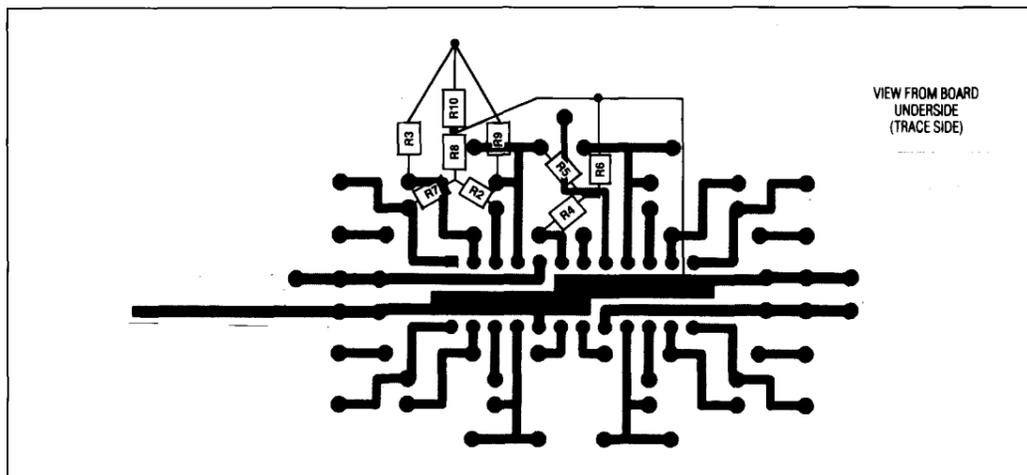


Figure 3. T-Network PC Board Connections

Recommended Resistor Sources

AVAILABLE TOLERANCES	TYPE	MANUFACTURER
1%, 0.1%, Others 5-100ppm/°C	Metal Film PTF Series	Dale 402-371-0800 FAX: 402-644-4206
1%, 0.1%	Surface Mount RN73H2B RN73E2B	KOA Speer 814-362-5536 FAX: 814-362-8883
1%, 0.1% to 2ppm/°C	PR, RL Series	Precision Resistive Products 319-394-9131 FAX: 319-394-9280

- BE SURE IC IS INSTALLED ON BOARD BEFORE POWER IS APPLIED. Single +5V or +10V operation: Install RS1 and RS2 (both 4.7kΩ). Install C1, C2, and CS1 - omit C3 and C4. Apply positive supply to V+, supply ground to V-. Do not connect any supply to GND. For dual supply (5V) operation, omit RS1 and RS2, and apply positive supply, negative supply, and ground to V+, V-, and GND respectively.
- Perform a frequency-response test for each filter section used (A,B,C, and D) to verify F_0/Q accuracy, before connecting them in series (cascading). For highest-accuracy results, perform frequency-response tests using a spectrum analyzer. Use the F_0 and Q measurement techniques described in the MAX274 data sheet in the *Measuring F_0 and Q* section. These methods apply to both lowpass and bandpass designs.

To measure filter section A's F_0 and Q, apply the test sweep signal at INA, measure BPOA. F_0 is the frequency at which INA and BPOA are exactly 180° out of phase. Q is determined by the formula:

$$Q = \text{FPK} / \text{-3dB bandwidth}$$

where FPK is the frequency at which the gain at BPOA is greatest (this may not be equal to F_0); and the -3dB bandwidth is the difference between the two frequencies at which BPOA is attenuated by 3dB from its peak gain. Repeat these measurements for filter sections B, C, and D. For more information, refer to Figure 2 of the MAX274 data sheet, *Bandpass Output*.

If the filter operates from a single supply, signals applied to the filters must be "centered" between V+ and V- so that signals remain in the common-mode range of the internal amplifiers.

- Cascade the filter sections (connect them in series) to produce the desired filter response. For example, for an 8th-order bandpass filter, use jumper wires to connect BPOA to INB, BPOB to INC, and BPOC to IND. Apply the signal input at INA; the filter output is taken at OUTD. If desired, connect the INPUT and OUTPUT BNC connectors to the input and output of the cascaded filter using jumper wires. For lowpass filters, cascade the sections using LPO_ as the outputs. For lower-order filters, omit unused sections; for higher than 8th-order filters, order additional MAX274 PC boards from Maxim to add the required number of sections.

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