



MAX9701 Evaluation Kit

Evaluates: MAX9701

General Description

The MAX9701 evaluation kit (EV kit) is a fully assembled and tested circuit board that uses the MAX9701 filterless Class D amplifier to drive a stereo bridge-tied-load (BTL) speaker in portable audio applications. Designed to operate from a 2.5V to 5.5V DC power supply, the EV kit is capable of delivering 1W per channel into an 8Ω load.

The EV kit accepts differential or single-ended input signals and provides an option to select between different switching frequency modes of operation.

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX9701EVKIT	0°C to +70°C	24 TQFN-EP*

*EP = Exposed Paddle.

Features

- ◆ Spread-Spectrum Modulation Lowers Radiated RF Emissions
- ◆ 2.5V to 5.5V Single-Supply Operation
- ◆ 1W Stereo Output (8Ω, V_{DD} = 5V, THD+N = 1%)
- ◆ Low 0.05% THD+N
- ◆ High 70dB PSRR
- ◆ No LC Output Filter Required
- ◆ 85% Efficiency (R_L = 8Ω, P_{OUT} = 500mW)
- ◆ Fully Differential Inputs
- ◆ Integrated Click-and-Pop Suppression
- ◆ Low Quiescent Current (8.5mA)
- ◆ Low-Power Shutdown Mode (0.1μA)
- ◆ Short-Circuit and Thermal-Overload Protection

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C4	4	1.0μF ±10%, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J105K Taiyo Yuden JMK107BJ105KA Murata GRM188R60J105K
C5	0	Not installed, capacitor (0805)
C6	1	10μF ±10%, 6.3V ceramic capacitor (0805) Murata GRM21BR60J106K
C7, C8, C9	3	0.1μF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K Taiyo Yuden EMK107BJ104KA Murata GRM188R71C104K
C10–C23	0	Not installed, capacitors (0603)
C24	1	100pF ±5%, 50V ceramic capacitor (0603) TDK C1608C0G1H101J Taiyo Yuden UMK107CH101JZ Murata GRM1885C1H101J
L1–L5	5	100Ω at 100MHz ferrite beads, 50mΩ DCR at 3A (0603) TDK MPZ1608S101A

DESIGNATION	QTY	DESCRIPTION
L6–L9	0	Not installed, inductors Recommended TOKO D53LC series
R1	1	49.9Ω ±1% resistor (0603)
R2–R5	0	Not installed, resistors (0603)
T1, T2	0	Not installed, common-mode chokes 50VDC, 1ADC 800Ω at 100MHz Recommended TDK ACM4532-801-2P-X
JU1	1	5-pin header
JU2, JU3, JU4	3	3-pin headers
JU5, JU6	2	2-pin headers
None	6	Shunts Digikey S9000-ND or equivalent
U1	1	MAX9701ETG (24-pin TQFN, 4mm x 4mm x 0.8mm)
U2	0	Not installed, MAX9700EBP-T (20-pin UCSP™)

UCSP is a trademark of Maxim Integrated Products, Inc.

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Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
Murata	770-436-1300	770-436-3030	www.murata.com
Taiyo Yuden	800-348-2496	847-925-0899	www.t-yuden.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com
TOKO	847-297-0070	847-699-1194	www.tokoam.com
Vishay	619-336-0860	619-474-8920	www.vishay.com

Note: Indicate that you are using the MAX9701 EV kit when contacting these component suppliers.

Quick Start

Recommended Equipment

- One pair of 8Ω speakers
- One 2.5V to 5.5V, 1A power supply
- One stereo audio source

Procedures

The MAX9701 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Do not turn on the power supply until all connections are completed:**

- 1) Verify that a shunt is installed across pins 1 and 2 of jumper JU1 (internal oscillator set to spread-spectrum mode).
- 2) Verify that a shunt is installed across pins 1 and 2 of jumper JU2 (EV kit ON).
- 3) Verify that a shunt is installed across pins 2 and 3 of jumper JU3 and pins 1 and 2 of jumper JU4 (gain = 12dB).
- 4) Verify that no shunt is installed across jumpers JU5 and JU6 (differential input mode).
- 5) Connect the 8Ω speakers across the OUTL+, OUTL- and OUTR+, OUTR- pads.
- 6) Ensure that the stereo audio source is turned off.
- 7) Connect the disabled audio source across the INL-, INL+ and INR-, INR+ pads.
- 8) Ensure that the DC power supply is off.
- 9) Connect the positive terminal of the power supply to the VDD pad and the power-supply ground terminal to the GND pad.
- 10) Turn on the DC power supply.
- 11) Enable the stereo audio source.

Detailed Description

The MAX9701 EV kit features the MAX9701 filterless Class D amplifier IC, designed to drive a BTL stereo speaker in portable audio applications. The EV kit operates from a DC power supply that is capable of providing 2.5V to 5.5V and 1A of current. The EV kit accepts differential or single-ended audio inputs. The audio input sources are amplified to drive 1W into each 8Ω speaker.

The EV kit provides three sets of differential outputs. The device outputs (OUT_+/-) can be connected directly to a speaker load without any filtering. However, a filter can be added to ease evaluation. The filtered outputs (TOUT_+/-) require installation of filtering components T1/T2 and C10–C13. When an LCR filter is required, ensure T1/T2 and C10–C13 are not installed; short T1-1 to T1-4, T1-2 to T1-3, T2-1 to T2-4, and T2-2 to T2-3 (Figure 1). The LCR filtered outputs (FOUT_+/-) require installation of filtering components L6–L9, C14–C23, and R2–R5. See Table 1 for the suggested filter component values for an 8Ω load and a 30kHz cutoff frequency. All recommended filtering components for an 8Ω load are included with the MAX9701 EV kit.

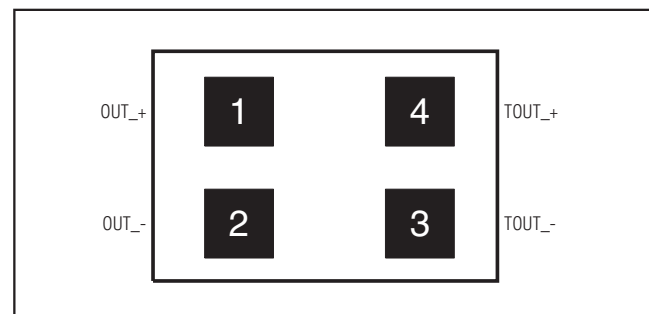


Figure 1. Common-Mode Choke

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Table 1. Suggested Filtering Components for an 8Ω load and a 30kHz Cutoff

COMPONENT	VALUE
L6–L9	15μH
C14, C18, C19, C23	0.033μF
C16, C21	0.15μF
C15, C17, C20, C22	0.068μF
R2–R5	22Ω

Jumper Selection

Operating Modes

Jumper JU1 provides an option to select the switching frequency of the MAX9701. See Table 2 for shunt positions.

Table 2. JU1 Jumper Selection

SHUNT POSITION	EV KIT FUNCTION
1-2 (V _{DD})	Spread-spectrum mode with f _{OSC} = 1200kHz ±60kHz
1-3 (FLOAT)	Fixed-frequency mode with f _{OSC} = 1400kHz
1-4 (Clocked)	Fixed-frequency mode with f _{OSC} = external, TTL-compatible clock frequency
1-5 (GND)	Fixed-frequency mode with f _{OSC} = 1100kHz

Shutdown Mode ($\overline{\text{SHDN}}$)

Jumper JU2 controls the shutdown pin ($\overline{\text{SHDN}}$) of the MAX9701. See Table 3 for shunt positions.

Table 3. JU2 Jumper Selection

SHUNT POSITION	EV KIT FUNCTION
1-2 ($\overline{\text{SHDN}}$ = high)	EV kit enabled
2-3 ($\overline{\text{SHDN}}$ = low)	Shutdown mode
None. External controller connected to $\overline{\text{SHDN}}$ pad (TTL).	$\overline{\text{SHDN}}$ driven by external controller. Shutdown is active low.

Gain Settings

Jumpers JU3 and JU4 provide an option to select the output voltage gain. See Table 4 for JU3 and JU4 shunt positions.

Table 4. JU3 (GAIN2) and JU4 (GAIN1) Jumper Selection

GAIN2	GAIN1	GAIN (dB)
Pins 2-3	Pins 2-3	18
Pins 2-3	Pins 1-2	12 (default)
Pins 1-2	Pins 2-3	6
Pins 1-2	Pins 1-2	0

Input Mode

Jumpers JU5 and JU6 provide an option to select between a differential or single-ended input mode for the EV kit. See Table 5 for shunt positions.

Table 5. JU5/JU6 Jumper Selection

SHUNT POSITION	EV KIT INPUT MODE
None (default)	Differential input mode
Installed (IN ₋ pads AC-coupled to GND)	Single-ended input mode

2.1 System Configuration

The MAX9701 and the MAX9700 can be configured as a 2.1 system (Figure 2). Stereo device U1 is the master amplifier; its oscillator output, SYNC_OUT, drives the SYNC input of the mono slave device (U2), synchronizing the switching frequencies of the two devices. Synchronizing the MAX9701 with the MAX9700 ensures that no beat frequencies within the audio spectrum occur on the power-supply rails. This 2.1 system configuration works when the master device is in either FFM or SSM mode.

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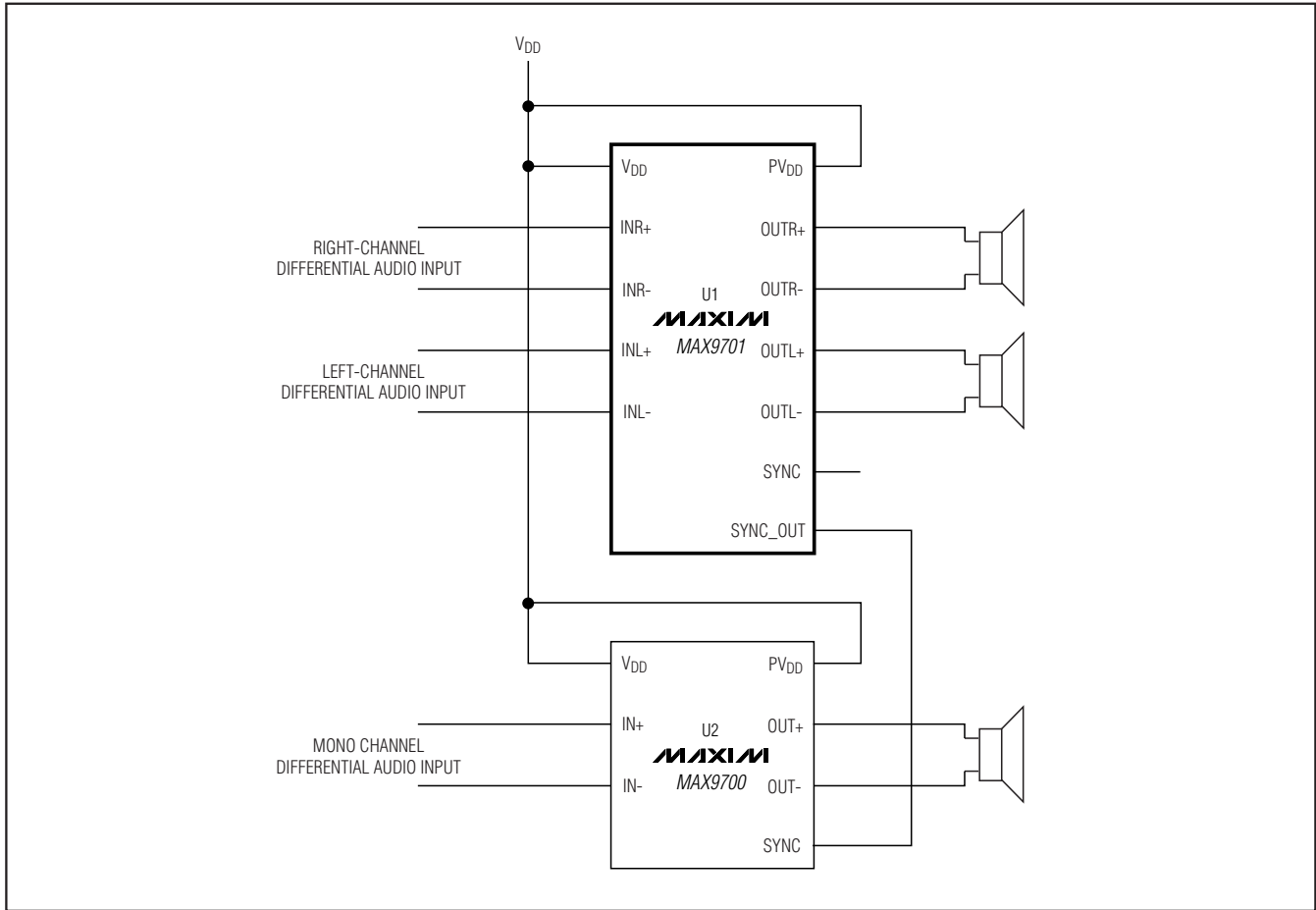


Figure 2. 2.1 System Configuration

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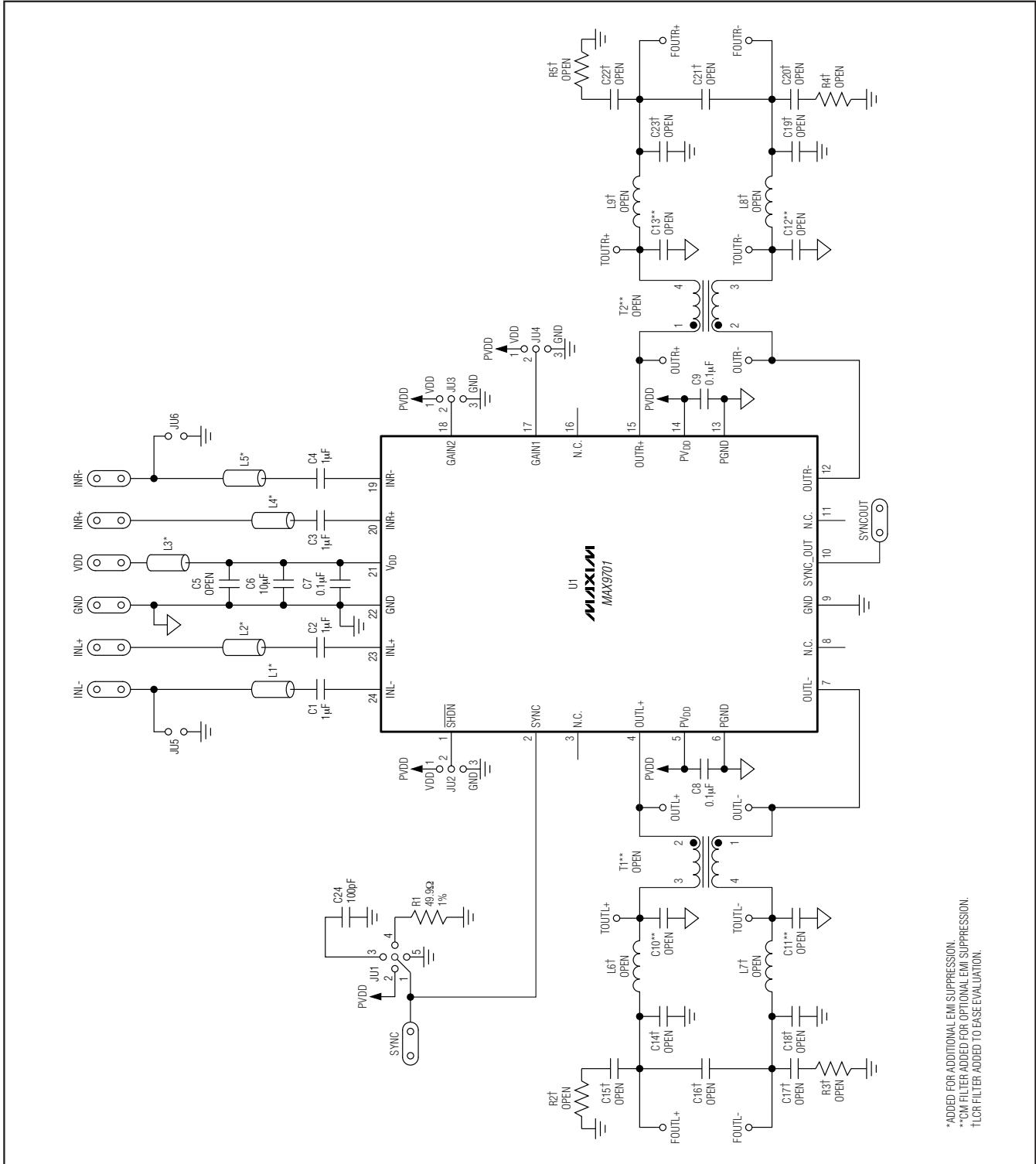


Figure 3. MAX9701 EV Kit Schematic

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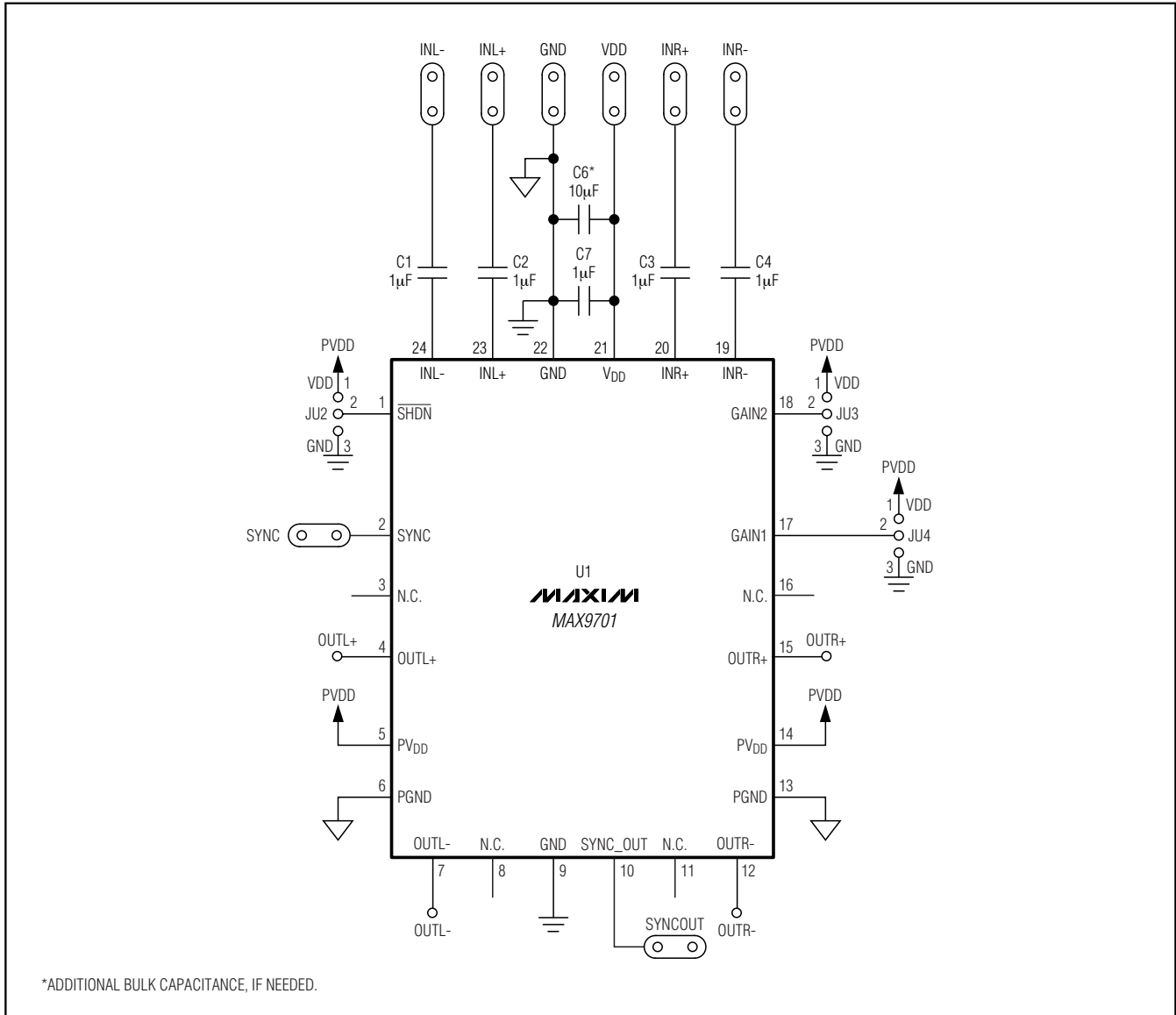


Figure 4. Simplified MAX9701 EV Kit Schematic. External components included in Figure 4 are necessary for device operation.

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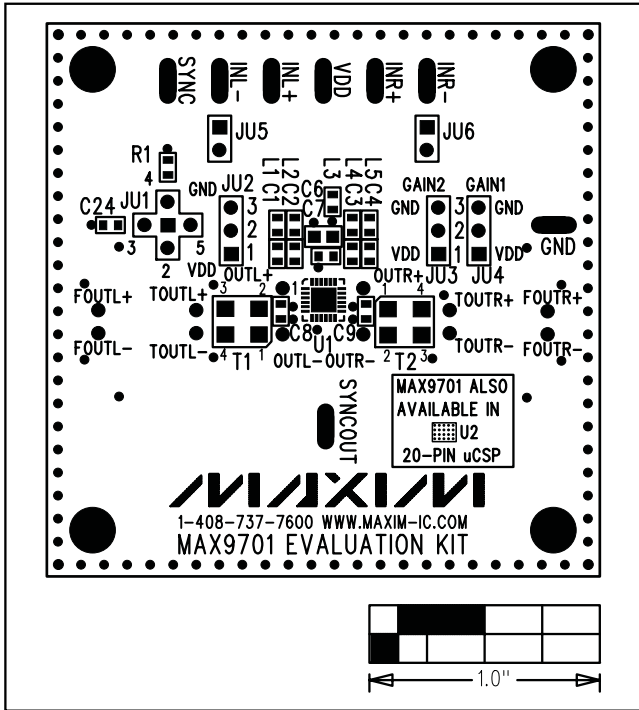


Figure 5. MAX9701 EV Kit Component Placement Guide—Component Side

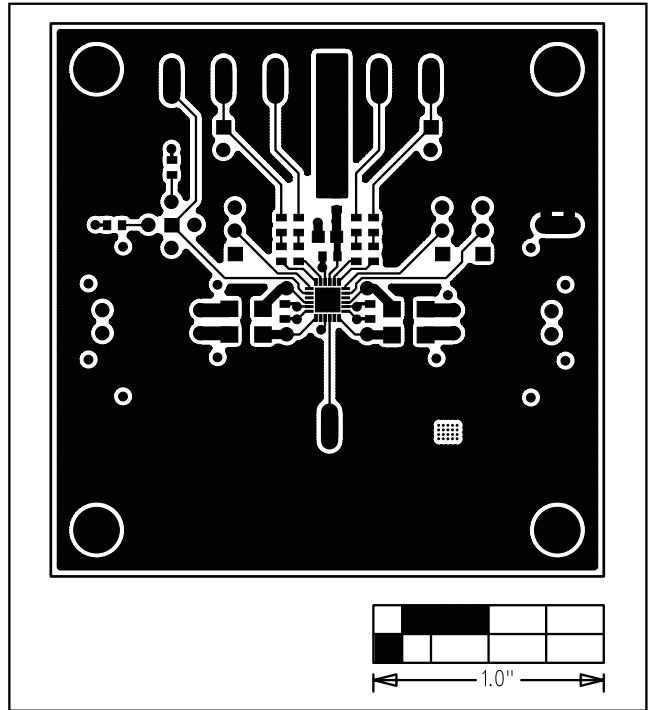


Figure 6. MAX9701 EV Kit PC Board Layout—Component Side

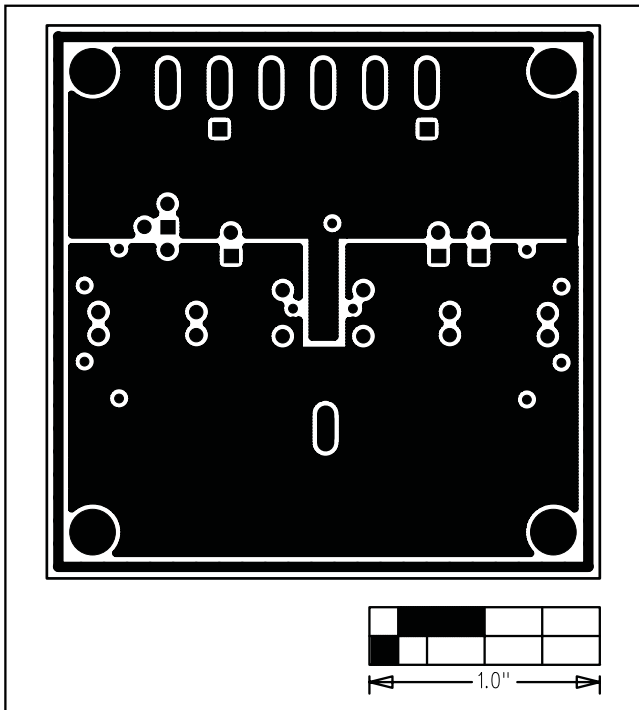


Figure 7. MAX9701 EV Kit PC Board Layout—GND/PGND Layer 2

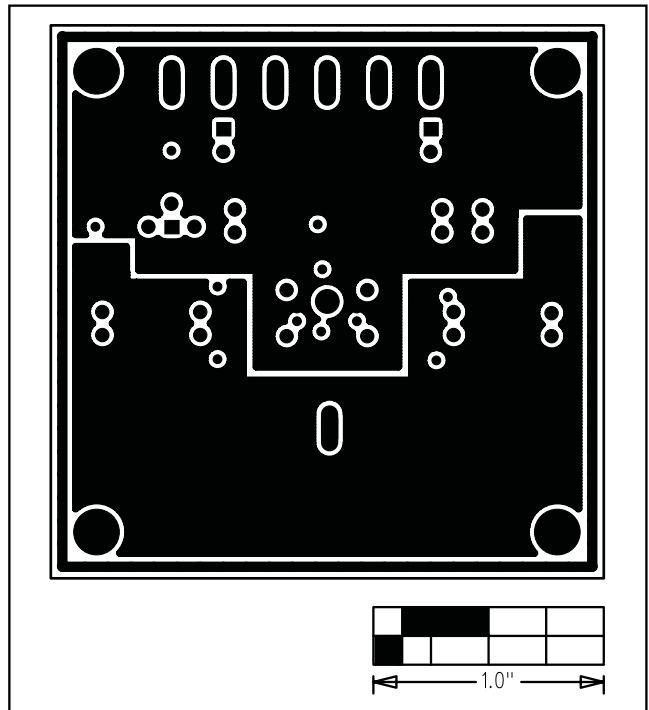


Figure 8. MAX9701 EV Kit PC Board Layout—PVDD/GND Layer 3

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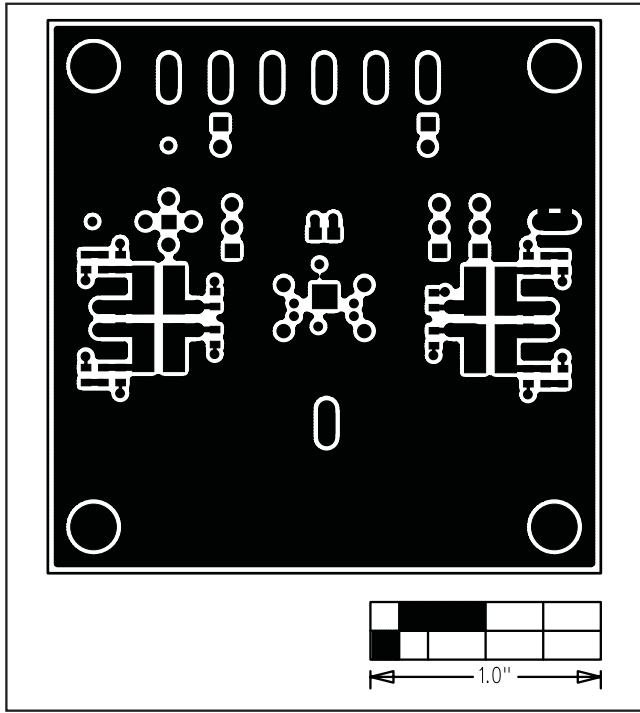


Figure 9. MAX9701 EV Kit PC Board Layout—Solder Side

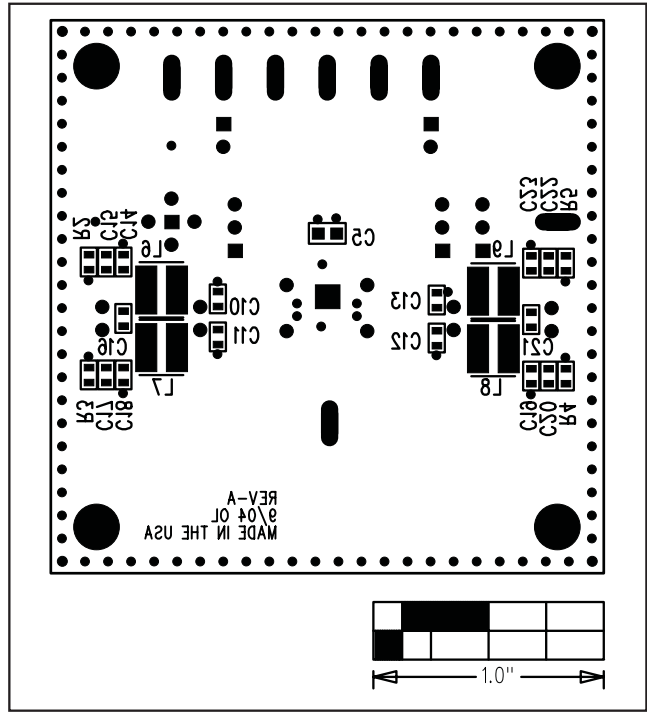


Figure 10. MAX9701 EV Kit Component Placement Guide—Solder Side

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