



MAX9741 Evaluation Kit

Evaluates: MAX9741

General Description

The MAX9741 evaluation kit (EV kit) is a fully assembled and tested circuit board that configures the MAX9741 Class D amplifier to drive 12W into a pair of 8Ω speakers in stereo for audio applications. The EV kit's speaker outputs can be filterless to minimize circuit area, or can be filtered to ease evaluation.

The MAX9741 EV kit operates from a 10V to 25V DC power supply. The EV kit accepts differential or single-ended input signals, and provides fully differential outputs. The EV kit provides an option to select between +13dB, +16dB, +19.1dB, or +29.6dB gains. The MAX9741 EV kit offers an option to select between fixed-frequency modulation (FFM) mode or spread-spectrum modulation (SSM) mode.

Features

- ◆ 10V to 25V Single-Supply Operation
- ◆ Differential or Single-Ended Input Modes
- ◆ Fully Differential Outputs
- ◆ Up to 88% Efficiency into 16Ω
- ◆ Drives 2 x 12W Continuous into 8Ω
- ◆ Drives 2 x 15W Continuous into 16Ω
- ◆ Low 0.1% THD+N
- ◆ Selectable Between Spread-Spectrum and Fixed-Frequency Modulation
- ◆ Pin-Selectable Gains (+13dB, +16dB, +19.1dB, +29.6dB)
- ◆ Surface-Mount Construction
- ◆ Fully Assembled and Tested

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX9741EVKIT	0°C to +70°C	56 TQFN-EP* (8mm x 8mm x 0.8mm)

*EP = Exposed paddle.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K TDK C1608X7R1H102KT
C2**, C3**	2	33μF ±10%, 35V tantalum capacitors (D case) AVX TAJD336K035
C4, C5	2	2.2μF ±10%, 25V X5R ceramic capacitors (0805) TDK C2012X5R1E225K or equivalent
C12–C15, C17	5	0.47μF ±10%, 6.3V X5R ceramic capacitors (0402) Murata GRM155R60J474K TDK C1005X5R0J474K
C16	1	0.01μF ±10%, 25V X7R ceramic capacitor (0402) TDK C1005X7R1E103K

DESIGNATION	QTY	DESCRIPTION
C18	1	1μF ±10%, 25V X7R ceramic capacitor (0805) TDK C2012X7R1E105K or equivalent
C19	1	0.1μF ±10%, 25V X5R ceramic capacitor (0402) TDK C1005X5R1E104K
C26, C27	2	100pF ±5%, 50V C0G ceramic capacitors (0402) TDK C1005C0G1H101J
U1	1	MAX9741ETN+ (56-pin TQFN, 8mm x 8mm)
OPTIONAL COMPONENTS FOR CUSTOMER DESIGN		
C6, C7	0	Not installed, 25V X5R or equivalent ceramic capacitors (0603)
C8–C11, C20–C23	0	Not installed, 25V X5R or equivalent ceramic capacitors (0805)

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
OPTIONAL COMPONENTS FOR CUSTOMER DESIGN		
C24, C25	0	Not installed, 25V X5R or equivalent ceramic capacitors (0402)
C28–C31	0	Not installed, stacked metallized film capacitors Panasonic ECQV1H103JL (recommended)
D1	1	5.1V, 20mA zener diode (SOT-23) Central CMPZ5231B (top mark C8F)
JU1, JU2, JU8	3	2-pin headers
JU3–JU7	5	3-pin headers

DESIGNATION	QTY	DESCRIPTION
OPTIONAL COMPONENTS FOR CUSTOMER DESIGN		
JU9	1	5-pin header Waldom: 26-48-1051
L1–L4	0	Not installed, power inductors Sumida CDRH104R series (recommended)
R1	1	10k Ω \pm 5% resistor (0402)
R2–R5	0	Not installed, resistors (0402)
OUTL+, OUTL-, OUTR+, OUTR-	0	Not installed, test points
—	8	Shunts
—	1	MAX9741 EV kit PC board

**Value may be reduced if MAX9741 is located close to power-supply output.

+Denotes lead-free package.

Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AVX	843-946-0238	843-626-3123	www.avxcorp.com
Central	631-435-1110	631-435-1824	www.centalsemi.com
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

Note: Indicate you are using the MAX9741 when contacting these manufacturers.

Quick Start

The MAX9741 EV kit is fully assembled and tested. Follow the steps listed below to verify board operation.

Do not turn on the power supply until all connections are completed.

Recommended Equipment

- 18V, 2.5A power supply
- Audio source (i.e., CD player, cassette player)
- 8 Ω /16 Ω speakers

Procedures

- 1) Verify that no shunt is across jumpers JU1 and JU2 (differential input mode).
- 2) Install shunts across pins 1 and 2 of jumper JU3 and jumper JU8 (EV kit is enabled).
- 3) Install shunts across pins 1 and 2 of jumpers JU4 and JU5 (gain = 16dB).
- 4) Install shunts across pins 1 and 2 of jumpers JU6 and JU7 (spread-spectrum mode, frequency centered at 670kHz).
- 5) Connect the speakers across the filterless output header JU9 (pin 1 = OUTL+, pin 2 = OUTL-, pin 3 = GND, pin 4 = OUTR+, and pin 5 = OUTR-).
- 6) Connect the positive terminal of the 18V power supply to the VDD pad and the ground terminal of the power supply to the GND pad.
- 7) Connect the audio source across the VINL+/VINL- and VINR+/VINR- pads.
- 8) Turn on the power supply, and then turn on the audio source.

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Detailed Description

The MAX9741 EV kit is designed to evaluate the MAX9741 in the 56-pin TQFN-EP package. The MAX9741 is a Class D amplifier that can be configured to drive 12W continuous into a pair of 8Ω speakers. The EV kit operates from a 10V to 25V DC power supply. The EV kit PC board has four layers with 2oz copper to optimize power dissipation.

The EV kit accepts a differential or single-ended audio input source, and provides fully differential outputs. The EV kit provides an option to select between +13dB, +16dB, +19.1dB, or 29.6dB gains. The MAX9741 EV kit offers an option to select between three frequencies (470kHz, 670kHz, or 970kHz) when in FFM mode or a single center frequency of 670kHz in SSM mode. Refer to the *Operating Modes* section in the MAX9741 IC data sheet for more information.

Filterless Output

The MAX9741 filterless outputs (OUTL+/OUTL- and OUTR+/OUTR-) can be connected directly to a pair of speaker loads without any filtering. Use JU9 to connect the speakers directly to the MAX9741 outputs.

Output Filtering

An audio analyzer typically cannot accept pulse-width-modulated (PWM) signals at its inputs. A filter can be added for ease of evaluation with a resistive load. The filtered outputs FOUTL+/FOUTL- and FOUTR+/FOURT- require installation of components L1–L4, C6–C11, C20–C23, and R2–R5.

Resistive Load

If evaluating the MAX9741 EV kit with resistive loads, an inductor is needed in series with the load to evaluate loudspeakers. With an 8Ω load, use a 68μH inductor; with a 16Ω load, use 100μH.

Table 1. Recommended Filter Components

PART	RECOMMENDED VALUE (8Ω)	RECOMMENDED VALUE (16Ω)
L1–L4	22μH	47μH
C6, C7	0.1μF	0.047μF
C20–C23	0.022μF	0.01μF
C8–C11	0.01μF	4700pF
R2–R5	100Ω	200Ω

Jumper Selection

Shutdown Mode

The MAX9741 EV kit operates from a DC power supply between 10V to 25V. The MAX9741 EV kit includes a zener diode to regulate the input power supply to +5V to power all logic circuits on the EV kit. Jumper JU3 sets the DVDD voltage and JU8 controls the $\overline{\text{SHDN}}$ pins. See Table 2 for JU3 and JU8 jumper selection.

Gain Selection

The MAX9741 features four gain settings. Jumpers JU4 and JU5 provide four options to select the desired output voltage gain. The gain of the MAX9741 is selectable between +13dB, +16dB, +19.1dB, and +29.6dB. See Table 3 for JU4 and JU5 functions. See Table 6 for power vs. gain and input levels.

Table 2. JU3 and JU8 Jumper Selection (Shutdown)

JU3 SHUNT POSITION	JU8 SHUNT POSITION	DVDD VOLTAGE (V)	EV KIT FUNCTION
Pins 1 and 2	Installed ($\overline{\text{SHDN}}$ = high)	DVDD = +5	EV kit enabled (default)
Pins 2 and 3	Installed, without external signal ($\overline{\text{SHDN}}$ = low)	DVDD = 0	MAX9741 in shutdown

Table 3. JU4 and JU5 Functions (G1 and G2)

JU4 SHUNT LOCATION	JU5 SHUNT LOCATION	MAX9741 OUTPUT GAIN (dB)
Pins 1 and 2 (G1 = high)	Pins 1 and 2 (G2 = high)	16 (default)
Pins 1 and 2 (G1 = high)	Pins 2 and 3 (G2 = low)	13
Pins 2 and 3 (G1 = low)	Pins 1 and 2 (G2 = high)	19.1
Pins 2 and 3 (G1 = low)	Pins 2 and 3 (G2 = low)	29.6

Note: Ensure a shunt is installed across pins 1 and 2 of jumper JU3.

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Frequency Modulation

The MAX9741 has two operating modes, FFM and SSM mode. There are three different frequencies in the fixed-frequency modulation mode of operation. JU6 and JU7 on the MAX9741 EV kit provide an option to select the different frequency modulations for the MAX9741. See Table 4 for JU6 and JU7 functions.

Input Mode

The MAX9741 EV kit features an option to select between single-ended and differential modes for the audio input source. JU1 and JU2 provide an option to select the input mode for the audio input source. See Table 5 for JU1 and JU2 functions.

Table 4. JU6 and JU7 Functions (FS1 and FS2)

JU6 SHUNT LOCATION	JU7 SHUNT LOCATION	MAX9741 SWITCHING FREQUENC (Hz)
Pins 1 and 2 (FS1 = high)	Pins 1 and 2 (FS2 = high)	670 ±7%, SSM (default)
Pins 1 and 2 (FS1 = high)	Pins 2 and 3 (FS2 = low)	470, FFM
Pins 2 and 3 (FS1 = low)	Pins 1 and 2 (FS2 =high)	930, FFM
Pins 2 and 3 (FS1 = low)	Pins 2 and 3 (FS2 = low)	670, FFM

Note: Ensure a shunt is installed across pins 1 and 2 of jumper JU3.

Table 5. JU1 and JU2 Functions (Single/Differential Input Mode)

JU1 and JU2 SHUNT POSITION	EV KIT INPUT MODE	AUDIO INPUT CONNECTION
Not installed	Differential input mode (default)	Connected to VINL+/VINL- and VINR+/ VINR- pads
Installed (VINL- and VINR- pad connected to AGND)	Single-ended input mode	Connect to VINL+ and VINR+ pads

Table 6. MAX9741 Power vs. Gain and Input Levels

GAIN (dB)	V _{IN} DIFF RMS (V)	R _L (Ω)	P _{out} at 10% THD+N (W)
13.0	2.23	8	16
	3.00	16	11
16.0	1.58	8	16
	2.12	16	11
19.1	1.11	8	16
	1.48	16	11
29.6	0.33	8	16
	0.44	16	11

Note: V_{DD} = 18V.

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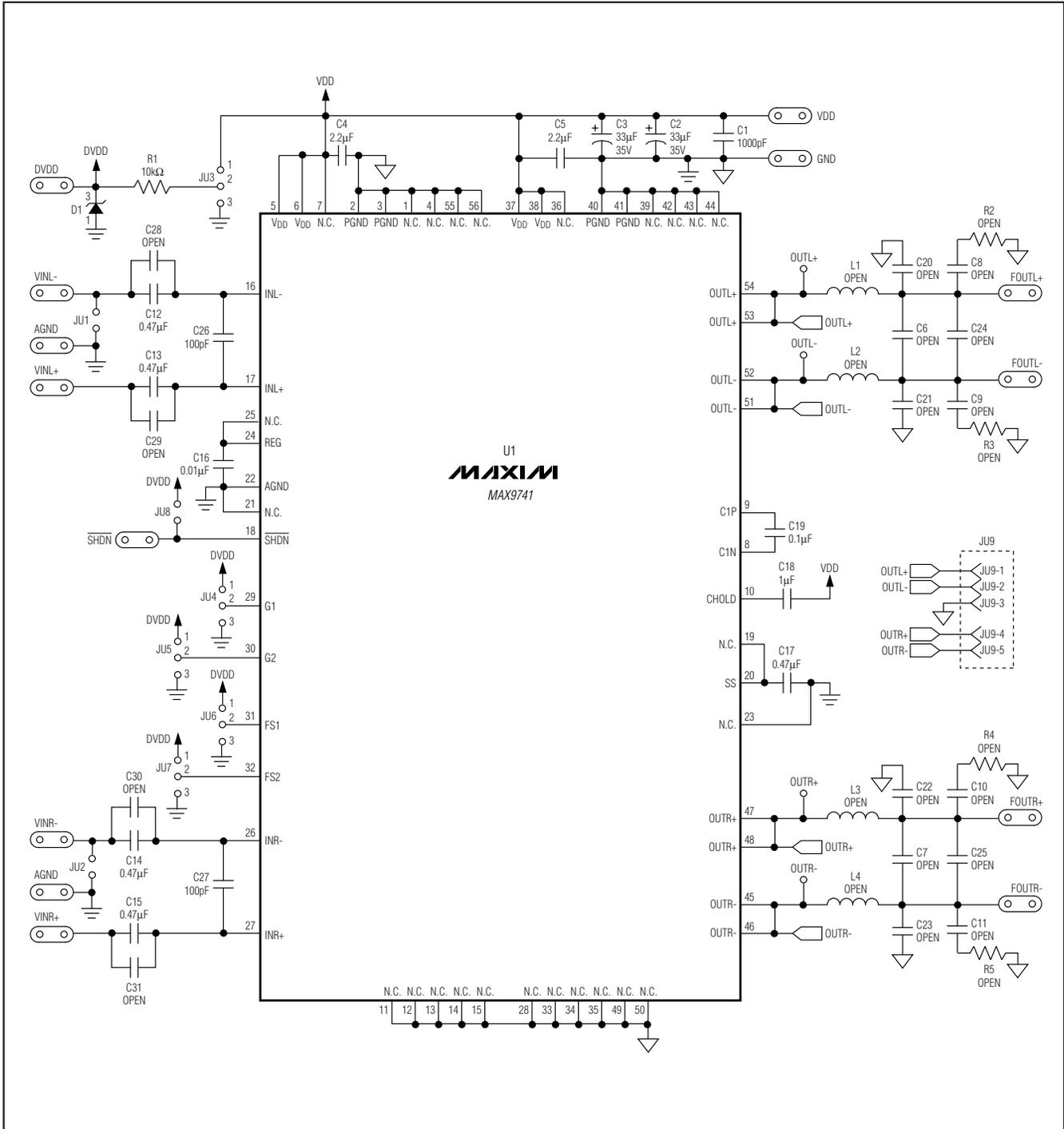


Figure 1. MAX9741 EV Kit Schematic

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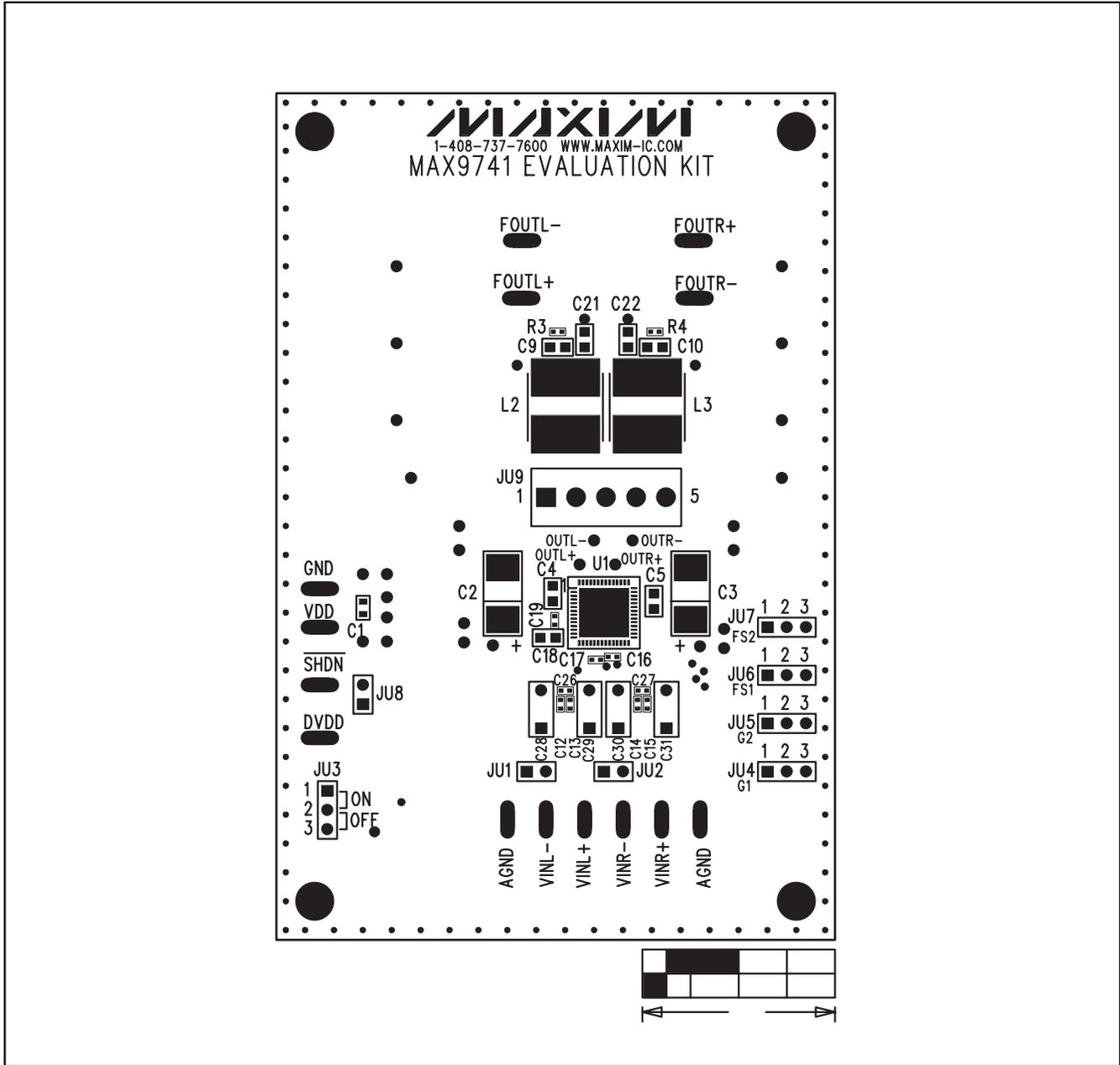


Figure 2. MAX9741 EV Kit Component Placement Guide—Component Side

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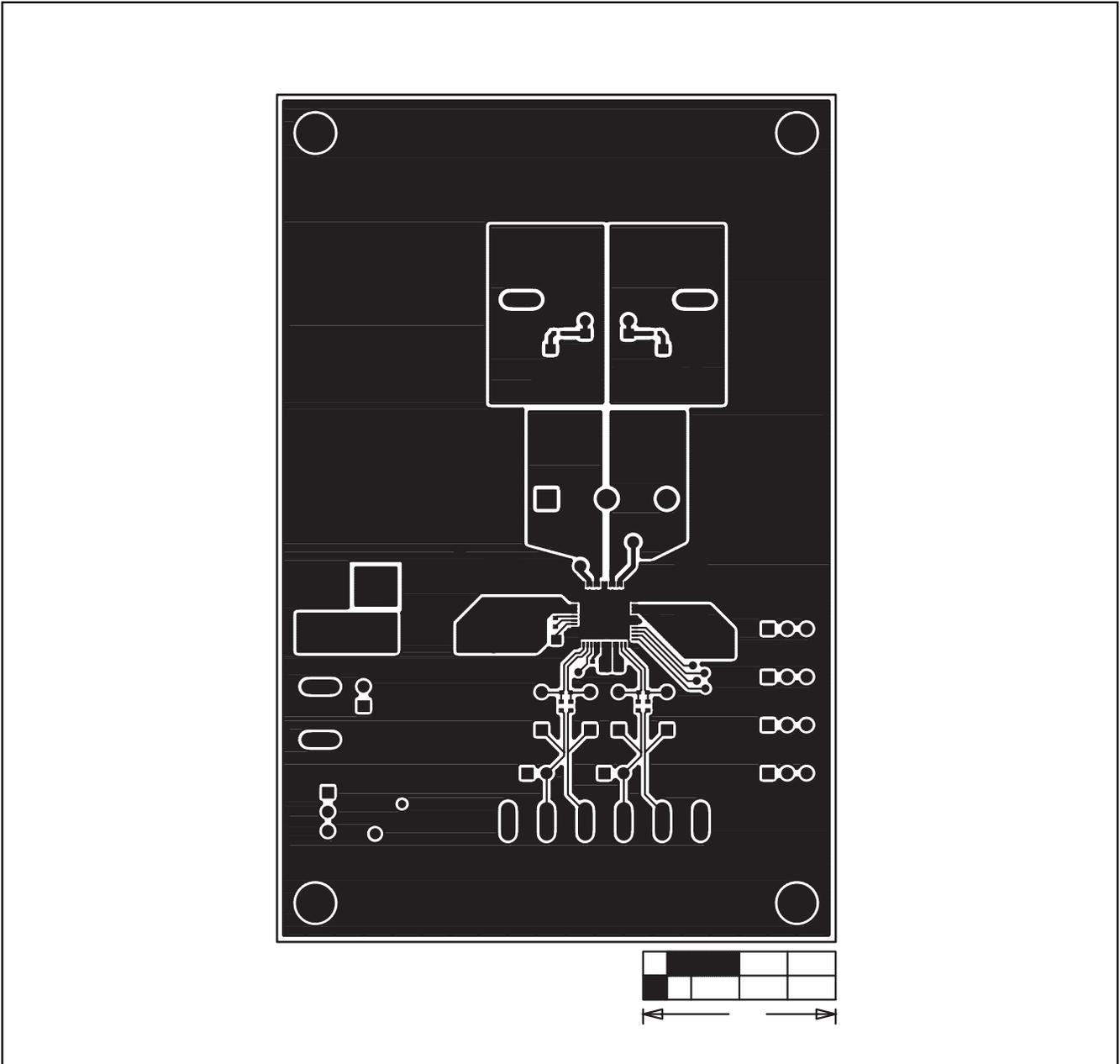


Figure 3. MAX9741 EV Kit PC Board Layout—Component Side

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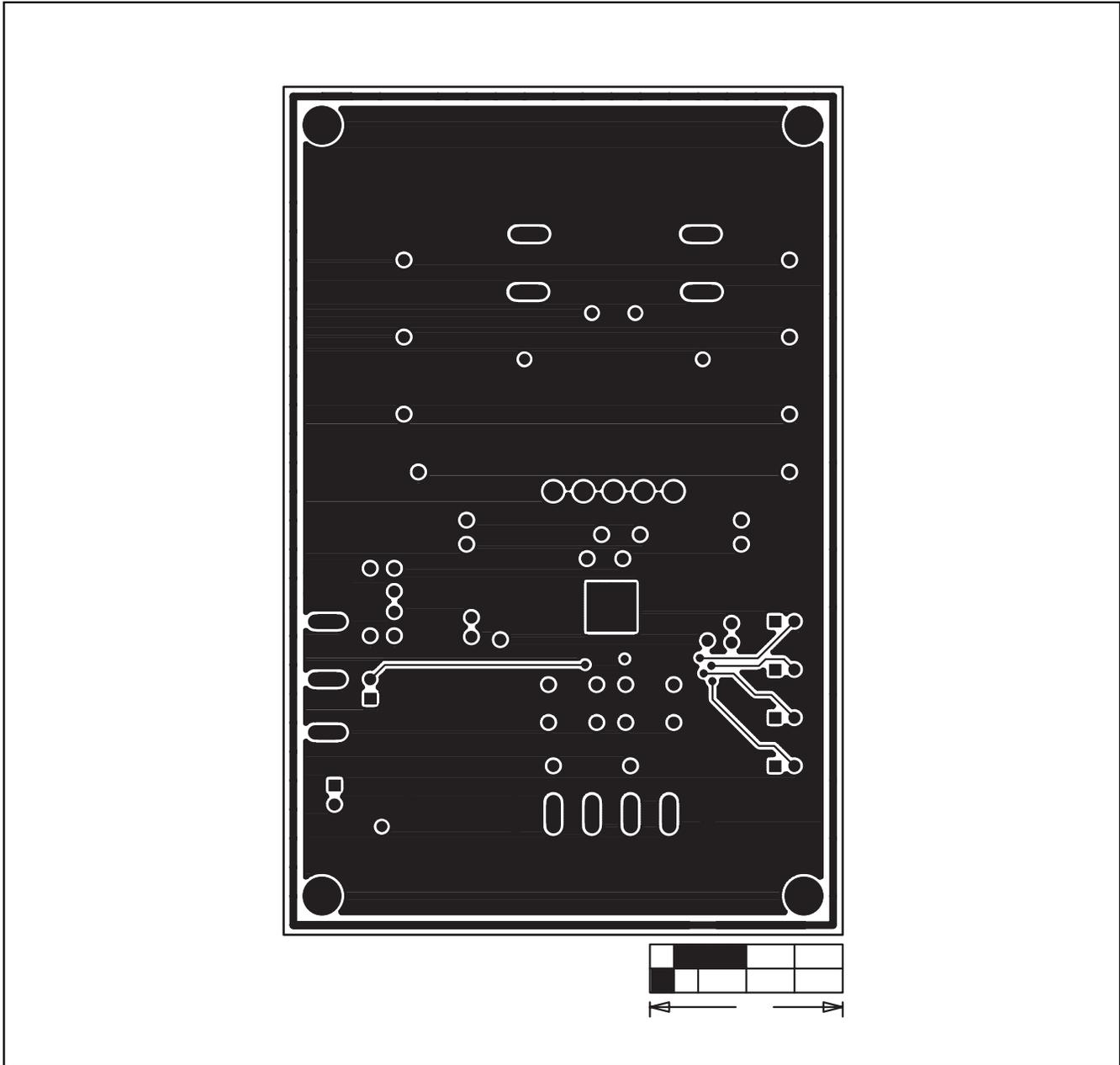


Figure 4. MAX9741 EV Kit PC Board Layout—Layer 2 (GND)

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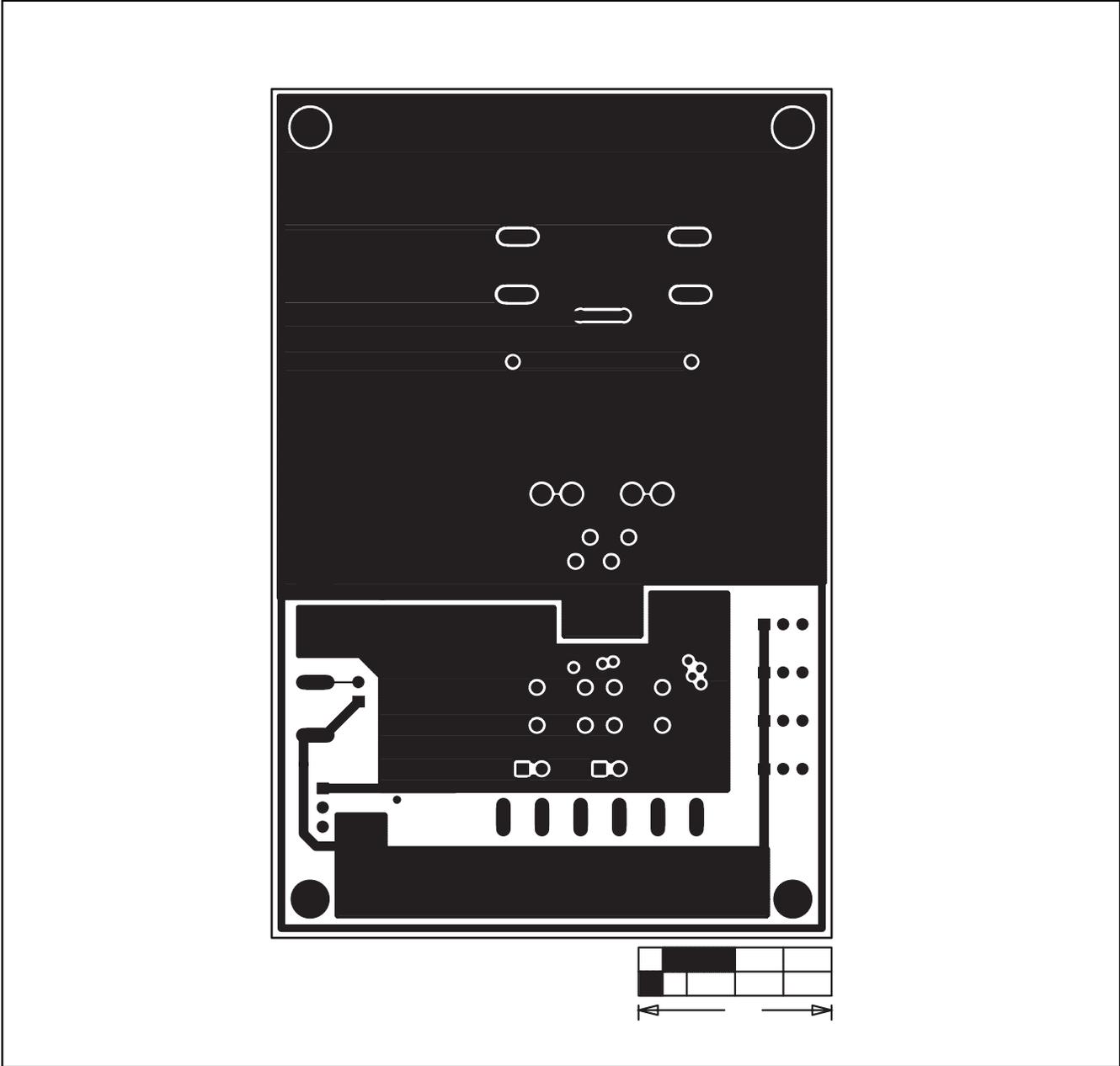


Figure 5. MAX9741 EV Kit PC Board Layout—Layer 3 (VDD)

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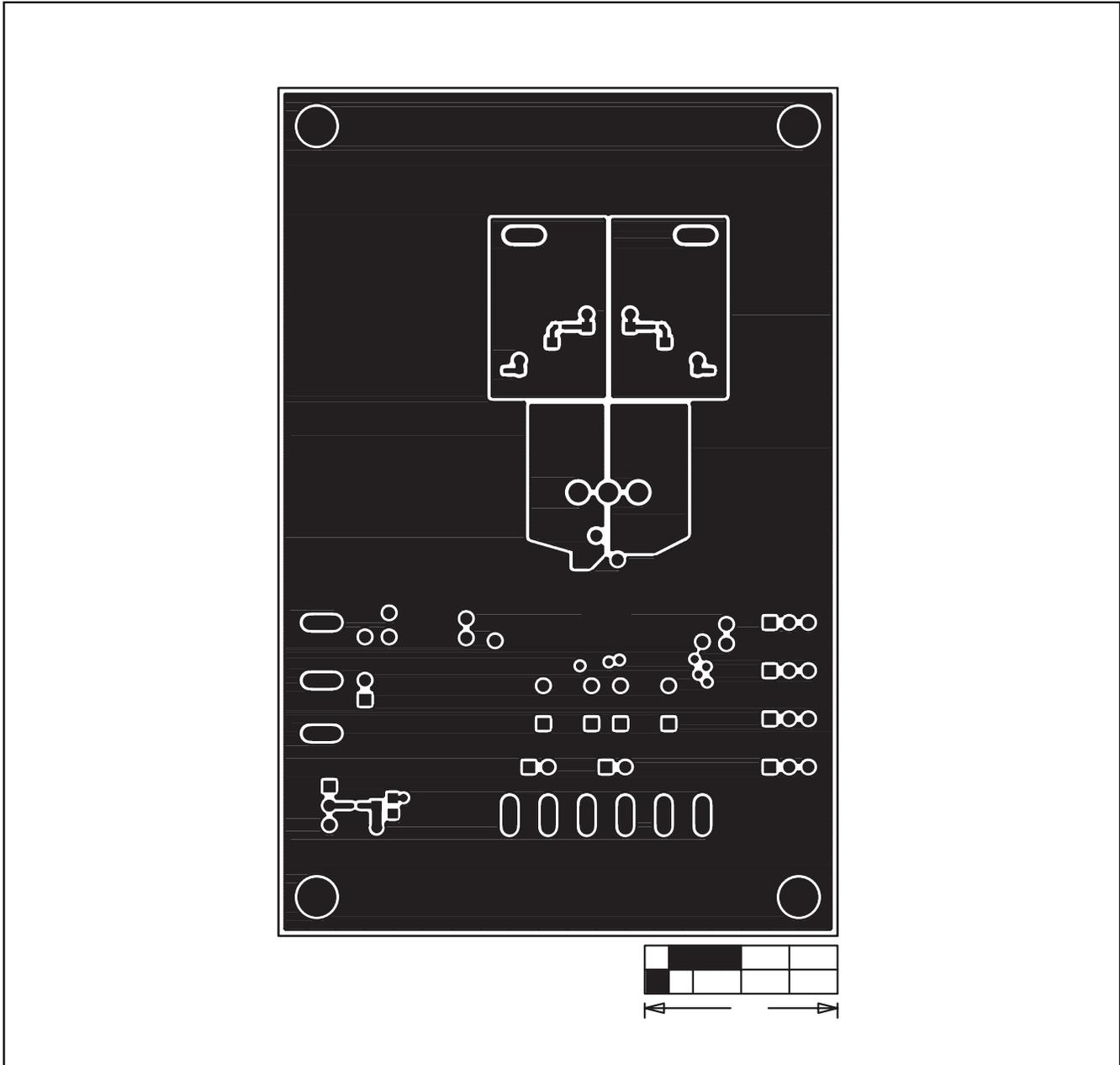


Figure 6. MAX9741 EV Kit PC Board Layout—Solder Side

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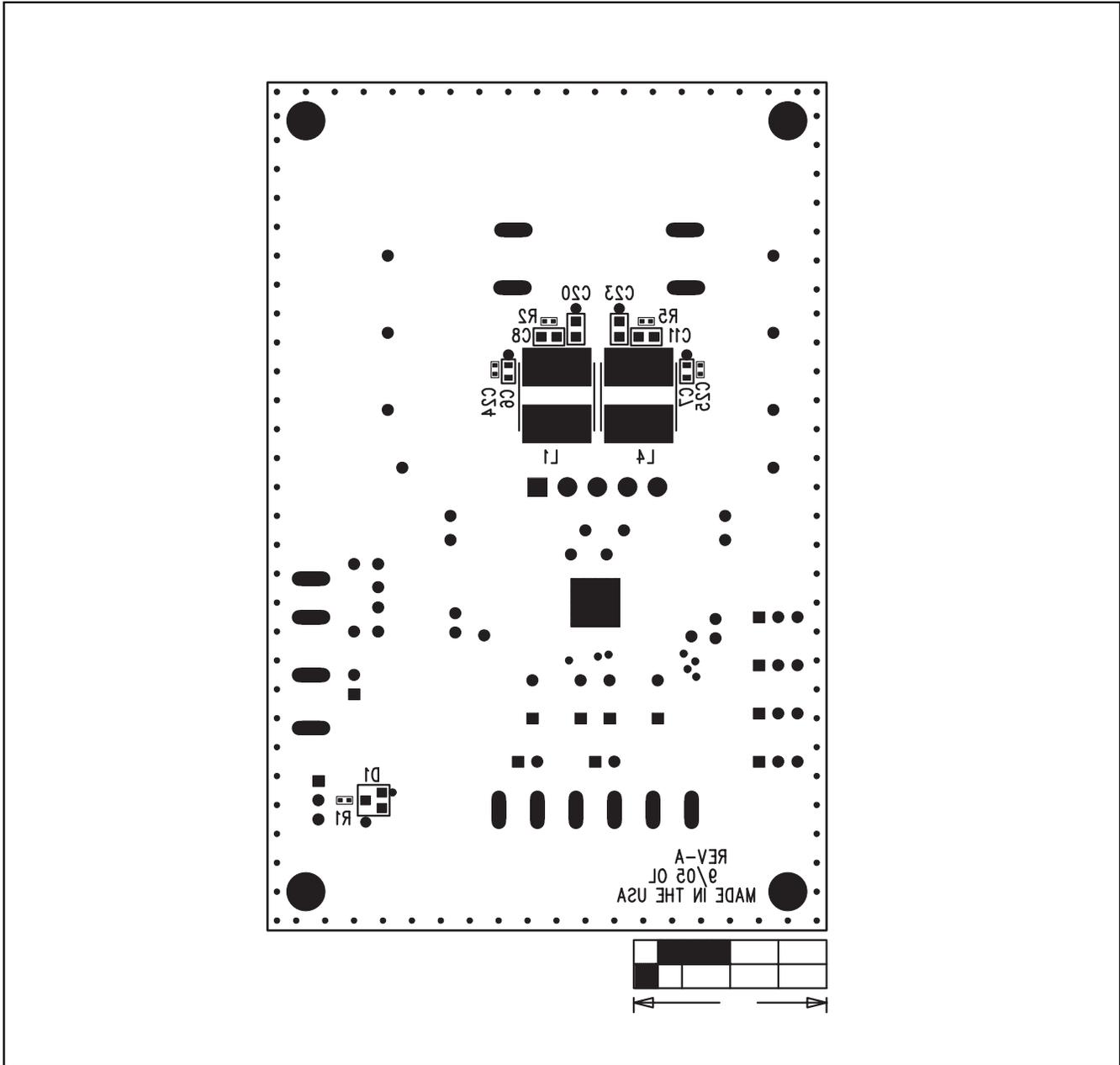


Figure 7. MAX9741 EV Kit Component Placement Guide—Solder Side

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