19-2714; Rev 0; 12/02

MAX5195 Evaluation Kit

Evaluates: MAX5195

General Description

The MAX5195 evaluation kit (EV kit) is a fully assembled and tested circuit board that contains all the components necessary to evaluate the performance of the MAX5195 14-bit, 260MHz digital-to-analog converter (DAC). The EV kit requires LVPECL-compatible data and clock inputs and two 5V power supplies for simple board operation and optimum performance.

Features

- **Fast Evaluation and Performance Testing**
- **LVPECL Compatible**
- **SMB Coaxial Connectors for Clock and Data Inputs**
- **SMA Coaxial Connector for DAC Output**
- **Differential Data Input Configuration**
- **On-Board Differential-to-Single-Ended Output Conversion Circuitry**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX5195EVKIT	0°C to +70°C	48 QFN-EP*

EP = Exposed paddle.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	10µF ±10%, 10V tantalum capacitors (A) AVX TAJA106K010R or Kemet T494A106K010AS
C3, C4	2	0.01µF ±10%, 16V X7R ceramic capacitors (0402) TDK C1005X7R1C103KT or Murata GRP155R71C103KA01
C5, C15, C18–C24, C26, C28	11	0.1µF ±10%, 10V X5R ceramic capacitors (0402) TDK C1005X5R1A104K or Murata GRP155R61A104KA01
C6–C14	9	47pF ±10%, 50V COG ceramic capacitors (0402) TDK C1005COG1H470JT or Murata GRP1555C1H470JZ01
C16	1	1µF ±10%, 10V X7R ceramic capacitor (0603) TDK C1608X7R1A105K
C17	0	Not installed, capacitor (A)
C25	1	2.2µF ±10%, 25V X7R ceramic capacitor (1206) TDK C3216X7R1E225K
C27	1	1000pF ±10%, 50V X7R ceramic capacitor (0402) TDK C1005X7R1H102KT or Murata GRP155R71H102KA01

DESIGNATION	QTY	DESCRIPTION
C29	0	Not installed, capacitor (0402)
D0P/N–D13P/N, CLKN, CLKP	30	SMB PC-mount vertical connectors
JU1, JU2	2	2-pin headers
L1, L2	2	5.6µH inductors Coilcraft 1008PS-562M
R1–R15	15	100Ω ±1% resistors (0402)
R16, R17	2	3.83kΩ ±1% resistors (0603)
R18, R19	2	27.4Ω ±1% resistors (0402)
R20	1	0Ω ±5% resistor (0603)
R21	1	3.9kΩ ±5% resistor (0402)
R22	1	6.8kΩ ±5% resistor (0402)
R23	0	Not installed, resistor (0402)
T1	1	Wideband RF transformer (1:1) Coilcraft TTWB1010-1
TP1–TP4	4	PC test points, red
TP5	1	PC test point, black
U1	1	MAX5195EGM (48-pin QFN)
U2	1	1.2 voltage reference (3-pin SOT23) MAX6120EUR
VOUT	1	SMA PC-mount vertical connector
VOUTP, VOUTN	0	Not installed, SMA PC-mount vertical connectors
None	2	Shunts (JU1, JU2)
None	1	MAX5195 PC board

Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AVX	843-946-0238	843-626-3123	www.avxcorp.com
Coilcraft	847-639-6400	847-639-1469	www.coilcraft.com
Kemet	864-963-6300	864-963-6322	www.kemet.com
Murata	770-436-1300	770-436-3030	www.murata.com
Panasonic	714-373-7366	714-737-7323	www.panasonic.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com

Note: *Please indicate that you are using the MAX5195 when contacting these component suppliers.*

Quick Start

Recommended equipment:

- DC power supplies
  - Digital: 5.0V, 300mA
  - Analog: 5.0V, 100mA
- Function generator with low-phase noise and low jitter for clock input (e.g., HP 8662A)
- Digital signal generator for LVPECL data inputs (e.g., Agilent 81250)
- Spectrum analyzer (e.g., HP 8560E)
- Digital voltmeter

The MAX5195 EV kit is a fully assembled and tested surface-mount board. Follow the steps below for board operation. **Do not turn on power supplies or enable signal generators until all connections are completed.**

1) To set full-scale current to 20mA, verify that shunt is installed across jumper JU1 or remove the shunt across jumper JU1 to set the full-scale current to 10mA.
2) Verify that a shunt is installed across jumper JU2 to use the 1.2V on-board external reference.
3) Synchronize the clock function generator (HP 8662A) to the CLOCK/REF input of the digital signal generator (Agilent 81250). See Figure 1 for equipment setup.
4) Verify that the digital signal generator is programmed for LVPECL-level outputs, which transition from 1.6V to 2.4V.
5) Connect the differential clock signal output from the digital signal generator to the CLKP (positive rail) and CLKN (complementary rail) SMB connectors on the EV kit.
6) Connect the 14-bit differential LVPECL outputs from the digital signal generator to the SMB input connectors on the EV kit. Connect the differential bit 0 to D0P and D0N, connect the differential bit 1 to D1P and D1N, etc.
7) Connect the spectrum analyzer to the VOUT SMA connector.
8) Connect the 5.0V, 300mA power supply to DVCC. Connect the ground terminal of this supply to DGND.
9) Connect the 5.0V, 100mA power supply to AVCC. Connect the ground terminal of this supply to AGND.
10) Turn on both power supplies.
11) With a voltmeter, verify that 1.2V is measured at test point TP2 on the EV kit.
12) Enable the function generator and the digital signal generator. Set the function generator (HP 8662A) for an output amplitude of +12dBm and frequency (f_{CLK}) ≤ 520MHz. Set the digital signal generator for clock frequency of 260MHz.
13) Use the spectrum analyzer to view the MAX5195 output spectrum or view the output waveform using an oscilloscope on VOUT.

Note: Set the Agilent 81250's internal divider to generate a 260MHz signal from the HP 8662A's 520MHz synchronous signal.

Detailed Description

The MAX5195 EV kit is designed to simplify the evaluation of the MAX5195 14-bit, 260MHz DAC. The board contains all circuitry necessary to evaluate the dynamic performance of this high-speed converter, including the circuit to convert the DAC's differential output into a single-ended output.

The EV kit provides connector pads for power supplies (DVCC and AVCC) and SMA/SMB connectors for the digital and clock differential LVPECL inputs (D0P/N–D13P/N, CLKP, CLKN), and the DAC output (VOUT) to simplify connection to the EV kit. The four-layer PC board is a high-speed design that optimizes the dynamic performance of the DAC by separating the analog and digital circuitry and implementing impedance matching to the differential input signal lines.

Power Supplies

The MAX5195 EV kit requires separate analog and digital power supplies for best performance. Connect a 5.0V power supply to the DVCC PC board pad on the EV kit to power the digital portion of the MAX5195 and the clock signal circuit. Connect the other 5.0V power supply to the AVCC PC board pad on the EV kit to power the analog portion of the DAC.

Digital Inputs

The MAX5195 EV kit provides high-frequency SMB connectors for the 14-bit, differential LVPECL input signal lines. Each differential matched-impedance pair features an on-board 100Ω termination resistor located near the DAC. The digital signal source must be programmed to supply differential LVPECL-standard logic levels with valid voltage levels of 1.6V and 2.4V. Connect each differential output bit from the digital signal generator to its corresponding SMB connector. Connect D0P–D13P to the positive signal connectors and their complementary signals to the D0N–D13N SMB connectors.

DAC Output

The MAX5195 is designed to supply a $0.5V_{P-P}$ to $1V_{P-P}$ differential output voltage range. This differential voltage is then used to drive transformer T1 to convert the differential voltage into a single-ended voltage that can be sampled at the VOUT SMA connector.

Clock

The MAX5195 EV kit requires an LVPECL differential clock signal input. The clock signal must be connected to the CLKP (positive rail) and CLKN (complementary rail) SMB connectors. The minimum clock frequency must follow the Nyquist criteria ($f_{CLK} \geq 2 \times f_{OUT}$).

Reference Voltage Options

The MAX5195 requires an input voltage reference at its REFIN pin to set the full-scale analog signal voltage output.

The EV kit circuit is designed with a 1.2V temperature stable, external voltage reference source (U2, MAX6120) that can be used in place of the internal reference provided by the MAX5195. The EV kit can be configured to use the on-board external reference by installing a shunt across jumper JU2. The user can also externally adjust the full-scale range by removing the shunt across jumper JU2 and supplying a stable, low-noise, external voltage reference to test point TP2. See Table 1 for jumper JU2 configuration.

The DAC also has a stable on-chip bandgap reference of 1.2V that can be accessed at test point TP1. To use the on-chip voltage reference, remove the shunt across jumper JU2, and connect test point TP1 to TP2.

Table 1. Reference Selection (Jumper JU2)

SHUNT POSITION	REFERENCE MODE
Installed	External 1.2V reference (U2) connected to REFIN pin on U1
Not Installed	User must supply a voltage reference to TP2 or use the internal 1.2V bandgap reference by connecting TP1 to TP2

Full-Scale Current

The MAX5195 DAC requires an external resistor connected from the RSET pin to ground to set the converter's full-scale current. The EV kit circuit is designed with a resistor option that allows the user to set the resistance value to 3.83kΩ or 7.66kΩ, which select a full-scale current of 20mA or 10mA, respectively. See Table 2 to configure jumper JU1 and select the full-scale current.

Table 2. Selecting Full-Scale Current (Jumper JU1)

SHUNT POSITION	FULL-SCALE CURRENT
Installed	20mA
Not Installed	10mA

Board Layout

The MAX5195 EV kit is a four-layer PC board design optimized for high-speed signals. All high-speed differential signals are routed through 100Ω impedance-matched differential transmission lines. The digital inputs are arranged in a circular pattern to match the line lengths between the DAC inputs. The length of these transmission lines is matched to within 50 mils to minimize layout-dependent data skew. The board layout separates the analog and digital portions of the circuit.

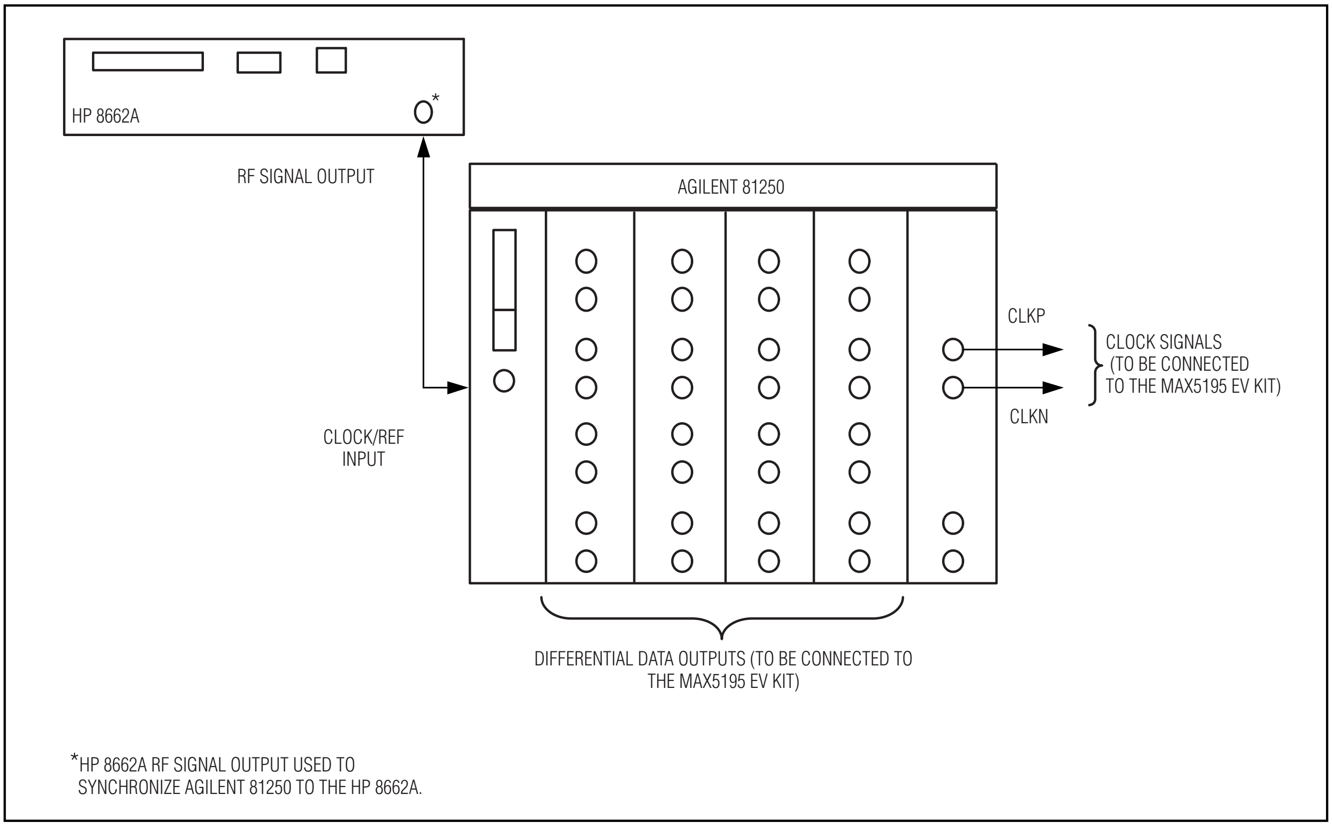

Figure 1. Data and Clock Equipment Setup for the MAX5195 EV Kit

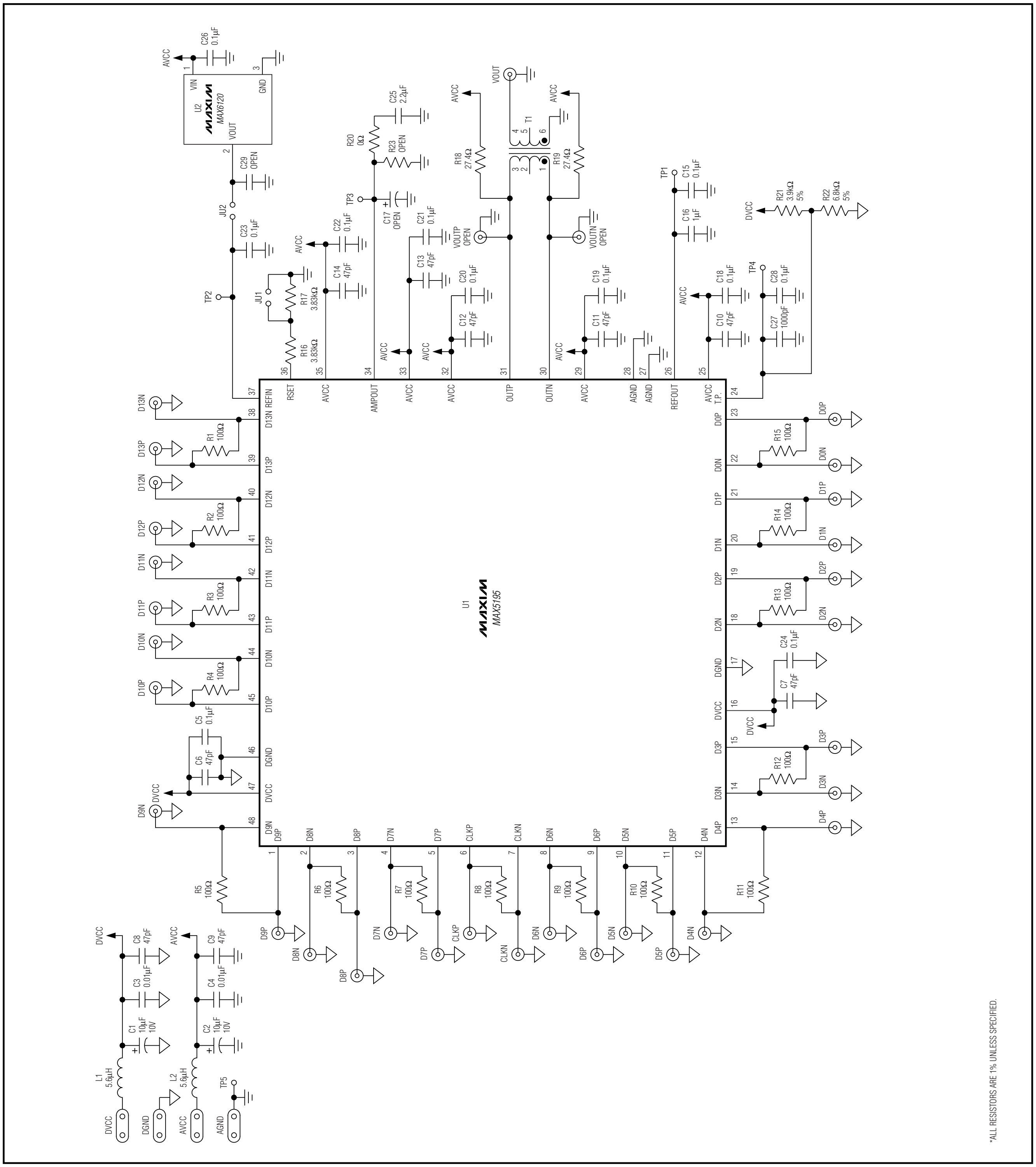

Figure 2. MAX5195 EV Kit Schematic

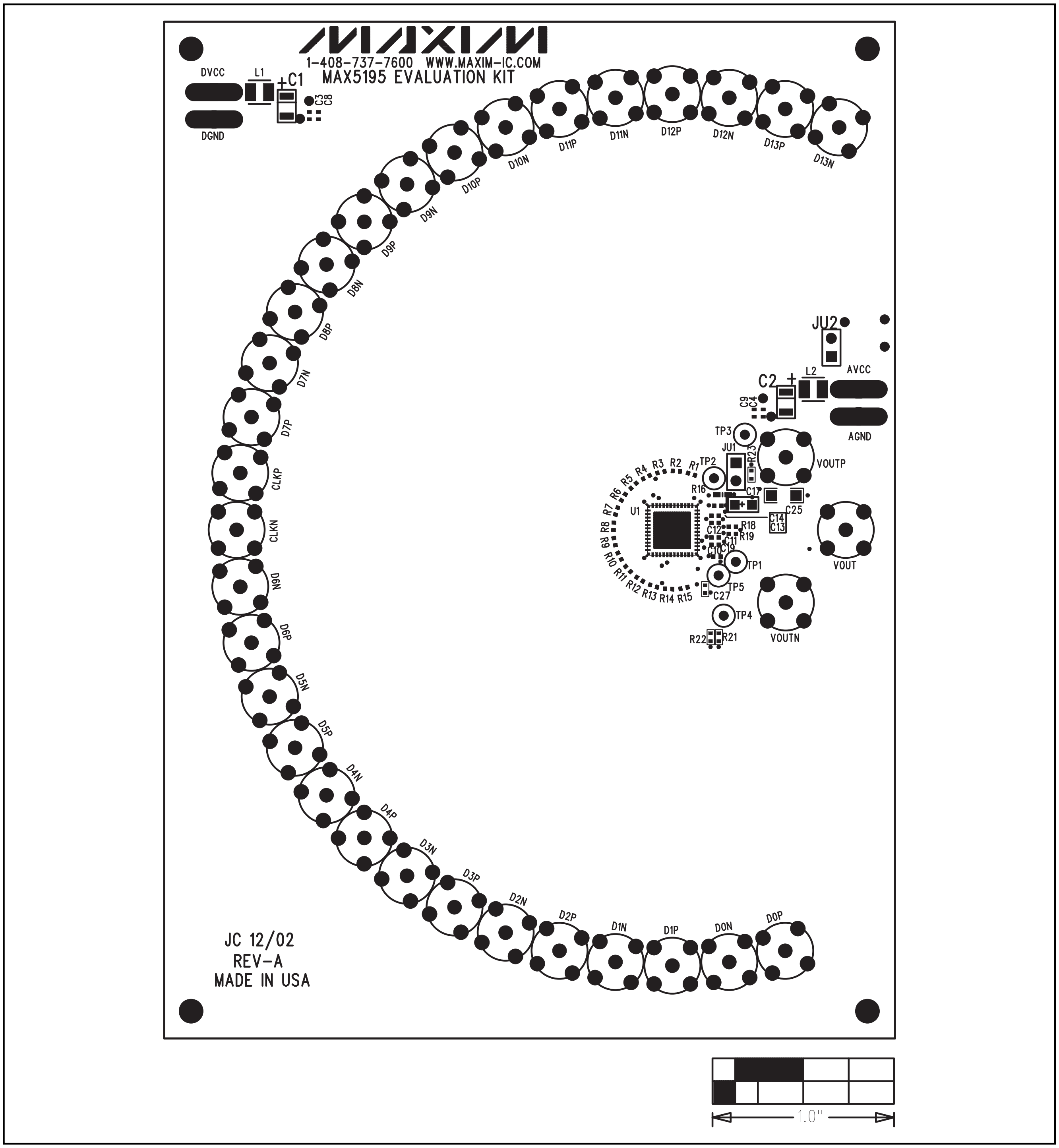

Figure 3. MAX5195 EV Kit Component Placement Guide—Component Side

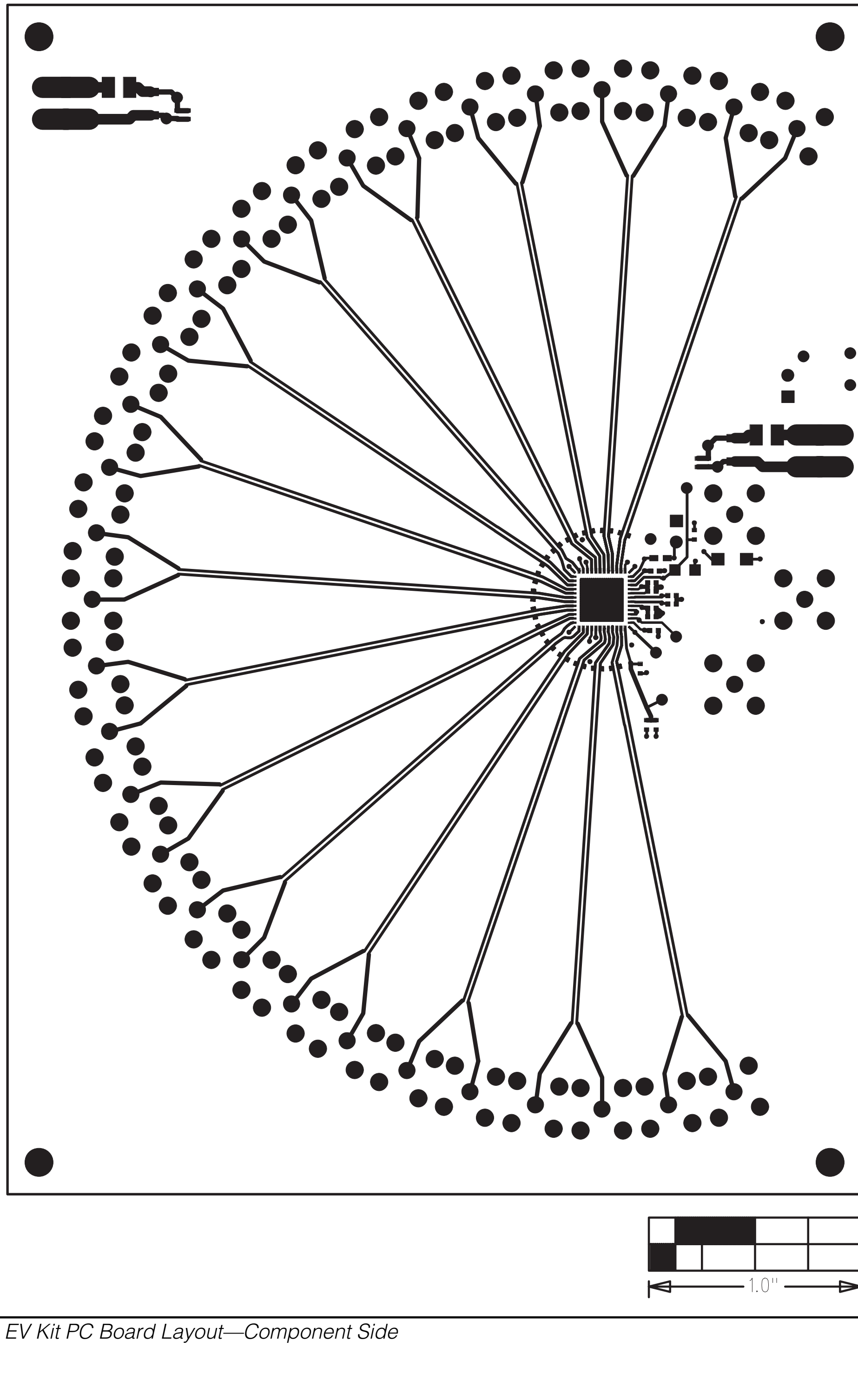

Figure 4. MAX5195 EV Kit PC Board Layout—Component Side

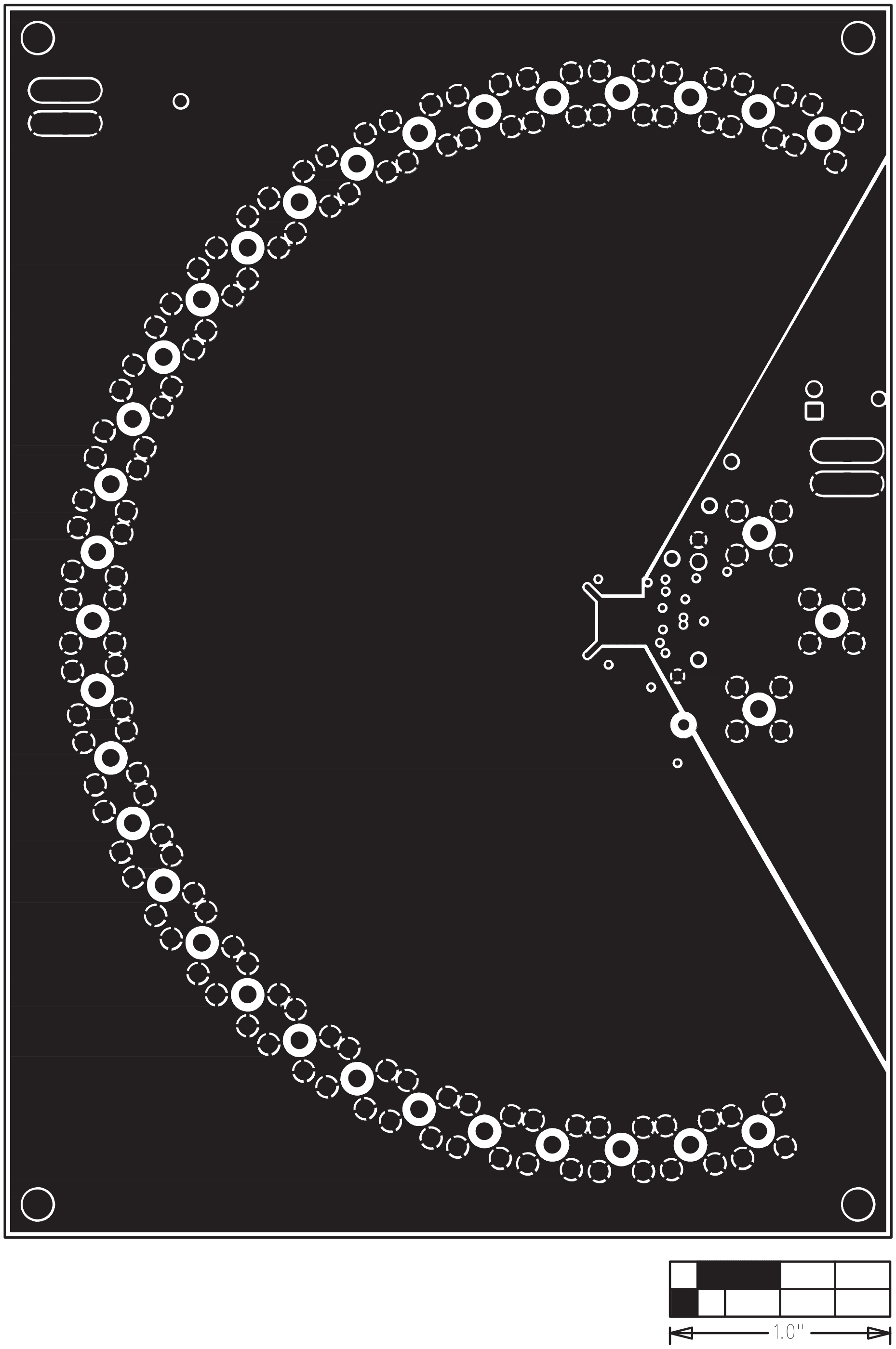

Figure 5. MAX5195 EV Kit PC Board Layout—Ground Planes

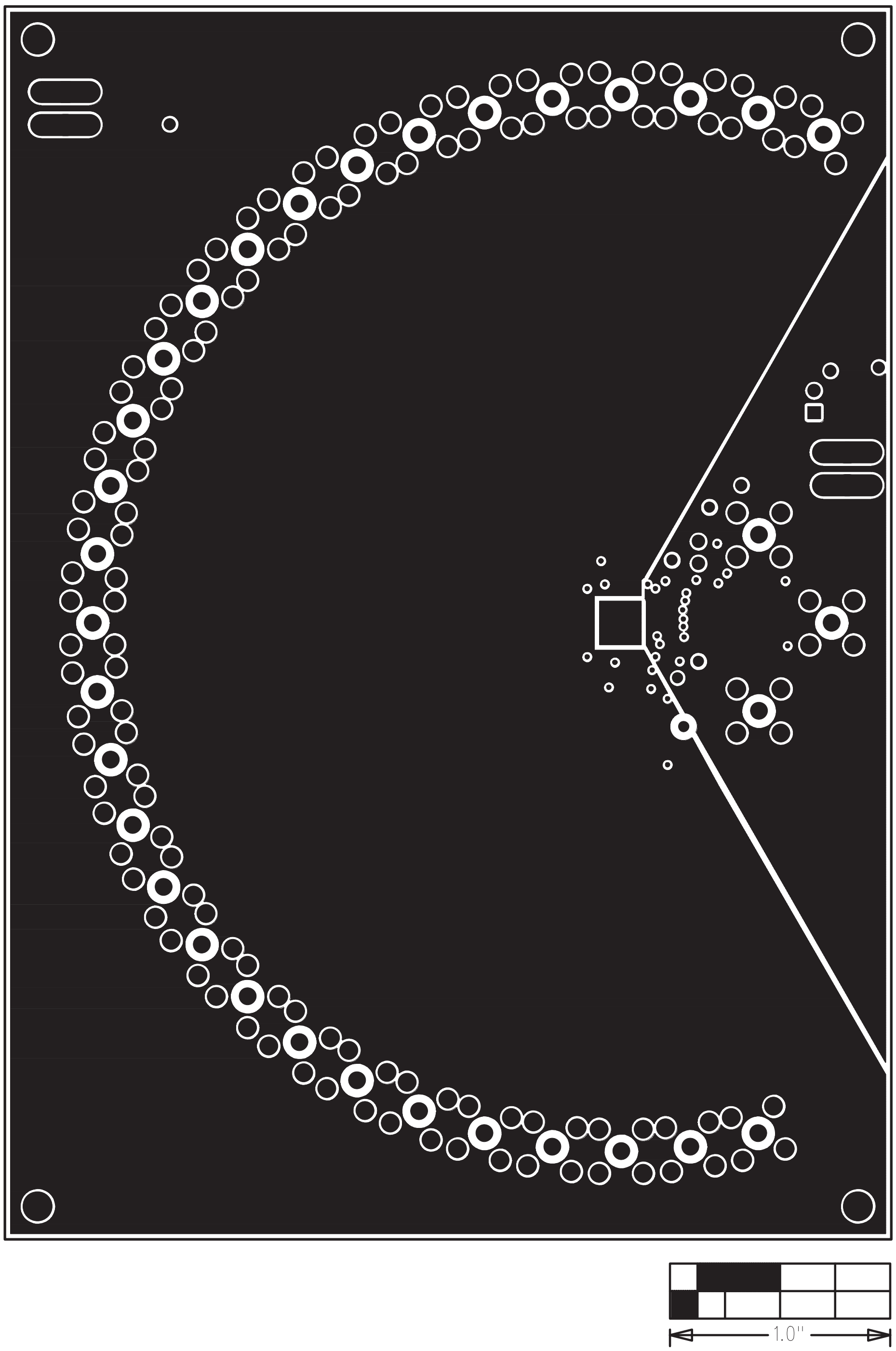

Figure 6. MAX5195 EV Kit PC Board Layout—Power Planes

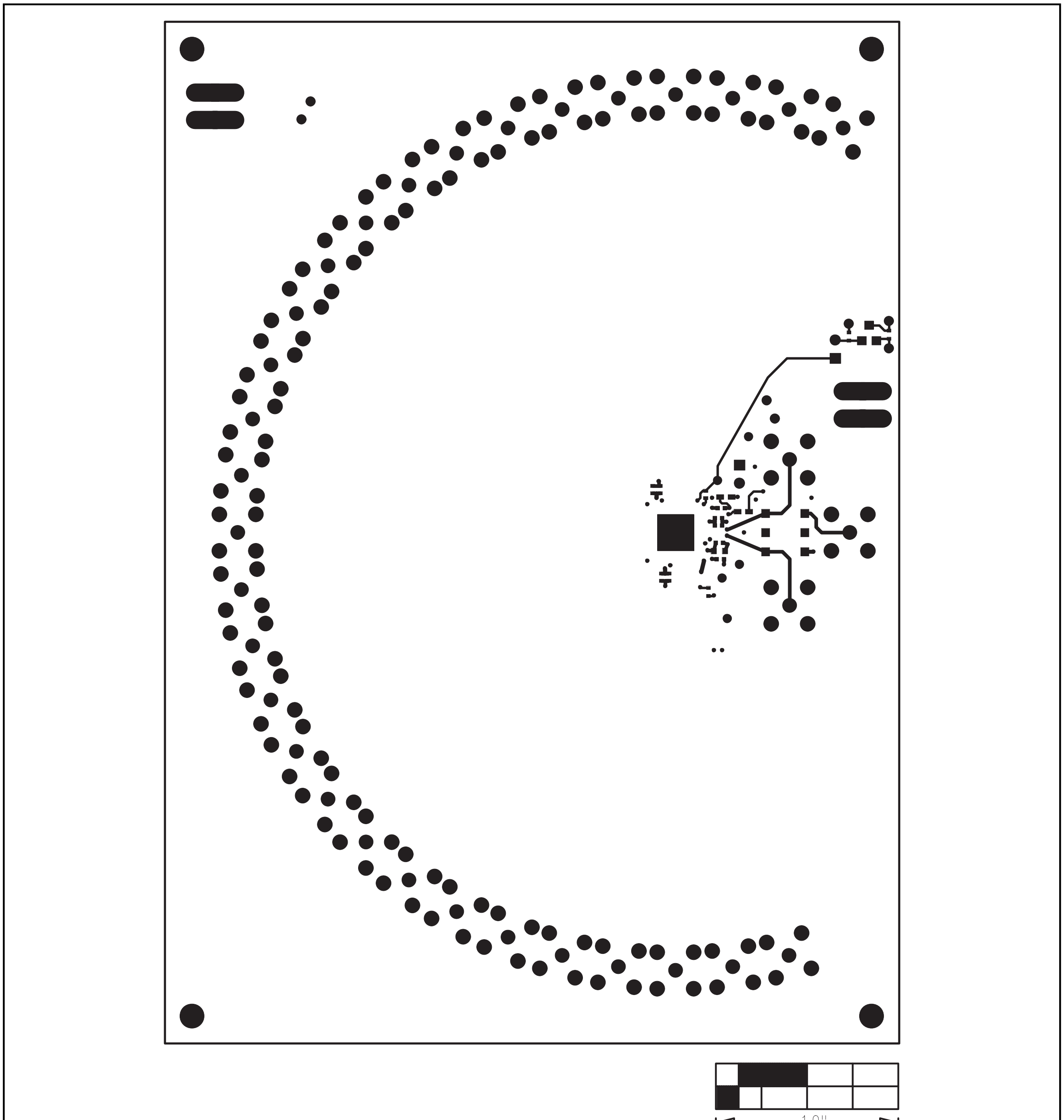

Figure 7. MAX5195 EV Kit PC Board Layout—Solder Side

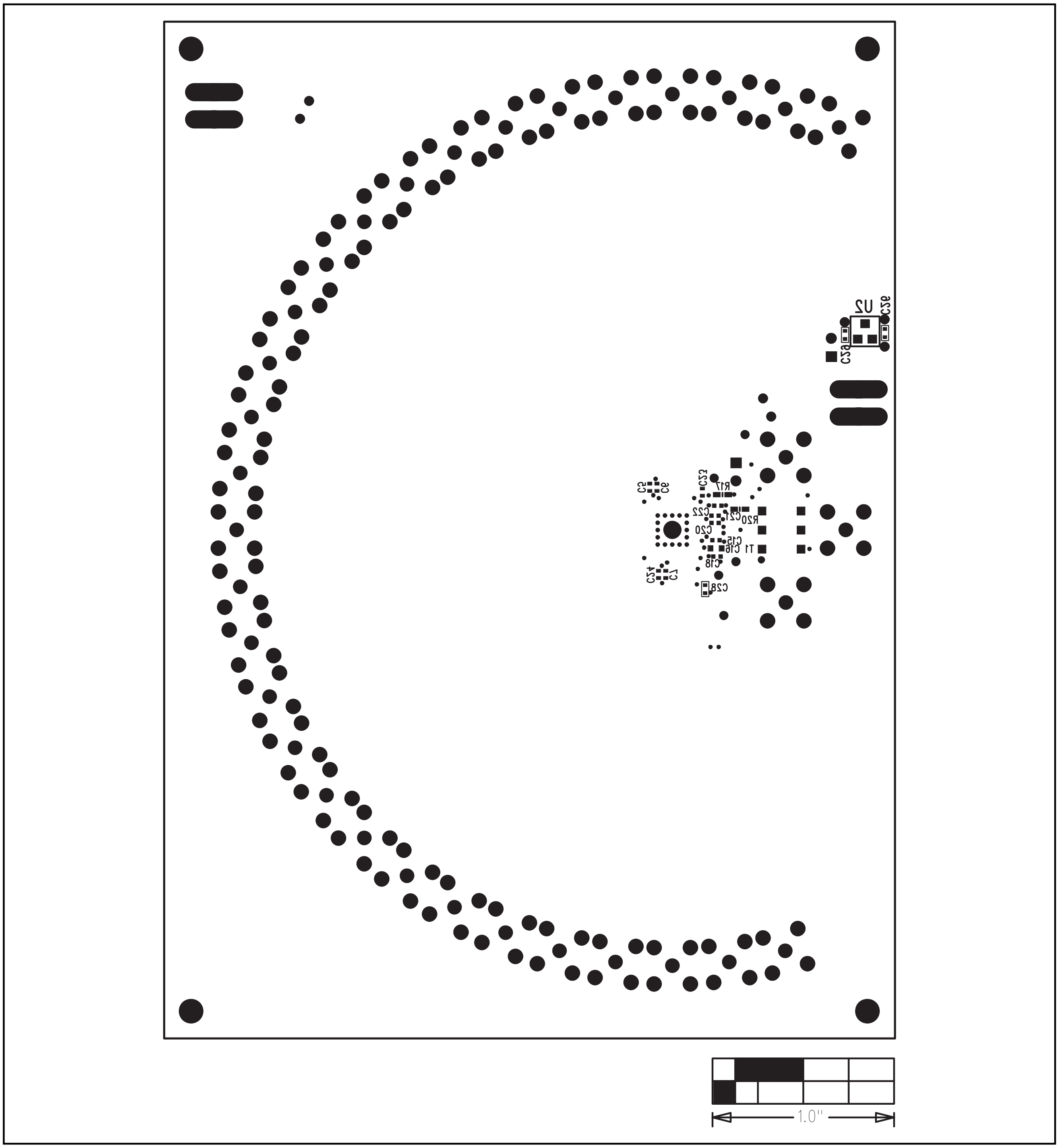

Figure 8. MAX5195 EV Kit Component Placement Guide—Solder Side