19-1669; Rev 0; 4/00

MAXIM

MAX5183 Evaluation Kit

Evaluates: MAX5180/82/83/85/86/88/89/91

General Description

The MAX5183 evaluation kit (EV kit) is designed to simplify evaluation of the 8-bit and 10-bit, dual, 40MHz, simultaneous-update or alternate-phase-update MAX5180/MAX5183, MAX5182/MAX5185, MAX5186/MAX5189, and MAX5188/MAX5191 digital-to-analog converters (DACs). The board contains all circuitry necessary for evaluating the dynamic performance of these high-speed converters, including a circuit to convert the DAC's differential outputs into single-ended outputs. Since the design combines high-speed analog and digital circuitry, the board layout calls for special precautions and design features.

Connector pads for power supplies (AVDD, DVDD, VCC, and VEE), DAC and amplifier outputs (OUT1P, OUT1N, VOUT1, OUT2P, OUT2N, and VOUT2), and SMA connectors for the digital and control inputs (D0–D9, $\overline{CS}$, CLK) simplify connection to the EV kit. The four-layer board layout is optimized for best dynamic performance.

The MAX5183 dual, 10-bit, 40MHz, simultaneous-update DAC is installed on the EV kit board. The kit can be used to evaluate the MAX5180, MAX5182, MAX5185, MAX5186, MAX5188, MAX5189, or MAX5191 with minor component changes.

Features

- ♦ **Fast Evaluation and Performance Testing**
- ♦ **SMA Coaxial Connectors for Clock and Data Inputs**
- ♦ **Performance-Optimized Four-Layer PC Board with Separate Analog and Digital Power and Ground Connections**
- ♦ **On-Board Differential to Single-Ended Conversion Circuitry**
- ♦ **Fully Assembled and Tested with MAX5183BEEI**

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX5183EVKIT	0°C to +70°C	28 QSOP

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C4, C8, C10, C12, C14, C18, C21, C23, C25	10	10µF, 16V tantalum capacitors
C2, C3, C6, C7, C9, C11, C13, C16, C17, C19, C20, C22, C24	13	0.1µF, 10V ceramic capacitors
C5, C15	0	2pF ceramic capacitors, optional output bandwidth-limiting capacitors (not supplied)
R1–R10, R13, R14	12	49.9Ω ±1% resistors
R11, R12, R30, R44	4	100Ω ±1% resistors
R15, R45	2	200Ω ±1% resistors
R16–R25, R28, R29, R35, R36, R41, R42, R43	0	Not installed, optional termination resistors for shunt configuration
R26, R27, R31, R39	4	24Ω, ±5% resistors
R35, R36, R41, R42	4	402Ω ±1% resistors (**Note:** Install to evaluate the current-output DACs MAX5180, MAX5182, MAX5186, and MAX5188.)
R43	0	10kΩ ±1% resistor, not supplied (**Note:** Install to evaluate the current-output DACs MAX5180, MAX5182, MAX5186, and MAX5188.)
JU1–JU7	7	3-pin headers
D0–D9, CLK, $\overline{CS}$	12	Female SMA connectors
L1	1	Ferrite bead Panasonic EXC-CL3216U1
OUT1P, OUT1N, OUT2P, OUT2N, REFO, AVDD, AGND, DVDD, DGND, VCC, VEE	11	Test points
U1	1	Maxim MAX5183BEEI dual DAC
U2, U3 U4, U5	4	Maxim MAX4108ESA low-distortion amplifiers
None	1	PC board
None	1	MAX5183 data sheet
None	1	MAX5183 EV kit data sheet
T1, T2	2	Baluns, Coilcraft TTWB1010-1
VOUT1, VOUT2	2	Scope-probe jacks

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MAX5183 Evaluation Kit

Quick Reference

The EV kit is delivered fully assembled, tested, and sealed in an antistatic bag. To ensure proper operation, open the antistatic bag only at a static-safe work area and follow the instructions listed below. **Do not turn on the power supplies until all power connections to the EV kit are established.** Figure 1 shows a typical evaluation setup for single-ended output operation:

1) Connect a **-5V** power supply to the pad marked **VEE**. Connect the supply's ground to the AGND pad. This negative supply for the MAX4108 amplifiers may also be connected to ground for single-supply operation.
2) Connect a **+3V** power supply to the pad marked **AVDD**. Connect the supply's ground to the pad marked AGND.
3) Connect a **+5V** power supply to the pad marked **VCC**. Connect the supply's ground to the pad marked AGND.
4) Connect a **+3V** power supply to the pad marked **DVDD**. Connect the supply's ground to the pad marked DGND.
5) Connect a word or pattern generator (e.g., Tektronix/Sony DG2020A) with the digitized pattern of a sinusoidal input signal to the digital data and control inputs (D0–D9, DACEN, $\overline{REN}$, PD, and $\overline{CS}$).
6) Connect an appropriate low-phase-noise clock signal generator (e.g., HP 8662A) to the clock input pin (CLK) of the DAC.
7) Connect the inputs of a four-channel digital oscilloscope (e.g., Tektronix TDS648B) to the outputs of OUT1P, OUT1N, OUT2P, and OUT2N, or connect two input channels to the pads marked VOUT1 and VOUT2 to observe the reconstructed output waveforms.
8) Ensure jumpers JU1–JU7 are configured to the default settings as shown in Tables 1–4. Tables 1 and 2 are for jumpers 1-3 only.
9) Turn on the supplies and signal sources.

Detailed Description

Digital Inputs

The MAX5183 EV kit board includes high-frequency SMA connectors for the digital data, clock, and control-line inputs (D0–D9, $\overline{CS}$, CLK). Each of these matched-impedance signal lines provides on-board series 50Ω termination resistors located in the signal path of the digital inputs to DGND. Optionally, 50Ω termination resistors to DGND may be user installed.

DAC Differential Outputs

The MAX5180/MAX5182/MAX5186/MAX5188 current-output DACs are designed to supply full-scale output currents of 1mA into 400Ω loads, in parallel with a capacitive load of 5pF. The MAX5183/MAX5185/MAX5189/MAX5191 voltage-output DACs have on-chip 400Ω resistors that restore the array currents to proportional, differential voltages of ±400mV full scale. These differential output voltages are then used to drive a balun transformer or a low-distortion, high-speed operational amplifier (such as the MAX4108 devices and transformers supplied in the EV kit, Figure 2) to convert the differential voltage into a single-ended voltage.

Alternately, outputs may be derived directly from the amplifier outputs or the DAC outputs (Tables 3, 4).

The MAX5183 EV kit is shipped with the necessary external circuitry to operate the installed MAX5183 voltage-output DAC. The full-scale output current-set resistor (R43) and the 402Ω conversion resistors (R35, R36, R41, R42) are not required for any of the voltage-output DACs and are therefore not installed on the MAX5183 EV kit.

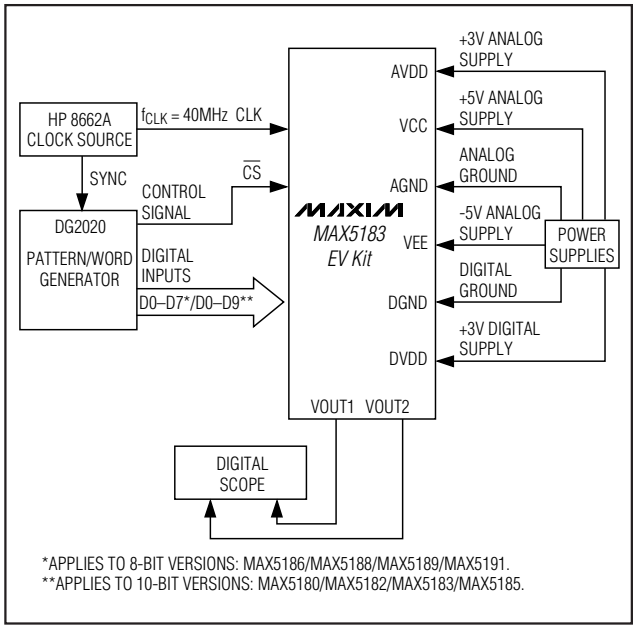

Figure 1. Typical EV Kit Test Setup for Single-Ended Operation

DAC Reference Options

The MAX5183 family features an on-chip +1.2V precision bandgap reference, which can be activated by connecting the reference enable pin $\overline{REN}$ to DGND. For this purpose, jumper JU1 must remain in location 2-3 (Table 1), which is the default location used when the board is shipped.

To disable the internal reference, connect $\overline{REN}$ to DVDD by placing jumper JU1 in location 1-2. A temperature-stable external reference may now be applied at the REFO pad to set the full-scale current/voltage output.

Standby Mode

To place the DAC in standby mode (Table 2), connect digital inputs PD and DACEN to DGND by setting jumpers JU2 and JU3 to locations 2-3. In standby, both the reference and the control amplifier are active, with the current array inactive. To exit this condition, pull DACEN high with PD held at DGND by leaving jumper JU3 in location 2-3 and changing jumper JU2 to location 1-2.

Shutdown Mode

For lowest power consumption, the MAX5183 EV kit provides a shutdown mode (Table 2) in which the reference, control amplifier, and current array are inactive and the converter's supply current is reduced to 1µA. To enter this mode, connect PD to DVDD by changing jumper JU3 to location 1-2. To return to active mode, connect PD to DGND by changing jumper JU3 to location 2-3, and connect DACEN to DVDD by changing jumper JU2 to location 1-2.

Power Supplies

The EV kit features separate analog and digital power and ground connections for best dynamic performance. It is not necessary to connect the analog and digital grounds together externally. The two grounds are connected together at a single point on the MAX5183 EV kit (at ferrite bead L1). The power-supply connectors are located at the top of the board.

Evaluating the MAX518x Family

The MAX5183 EV kit may be used to evaluate other MAX518x family 8-bit and 10-bit dual DACs. The changes required for this are listed in Table 5.

When evaluating the MAX5186/MAX5189 (dual, 8-bit DACs with simultaneous update) and the MAX5188/MAX5191 (dual, 8-bit DACs with alternate-phase update), input data bits D0 and D1 must be connected to DGND to ensure proper operation.

Table 1. Selecting Reference Mode

$\overline{REN}$ JUMPER (JU1) POSITION	REFERENCE MODE
1-2	Connect external precision reference at REFO.
2-3*	Internal +1.2V bandgap reference active

**Indicates default jumper state*

Table 2. Selecting Power-Down Mode

PD JUMPER (JU3) POSITION	DACEN JUMPER (JU2) POSITION	POWER-DOWN MODE
1-2	X	Shutdown
2-3	2-3	Standby
2-3*	1-2*	Normal operation

X = Don't care
**Indicates default jumper state*

Table 3. Alternate Output Drive (OUT1N, OUT1P) Selection

JU4 POSITION	JU5 POSITION	OUT1N, OUT1P PADS
1-2	1-2	Direct DAC outputs for voltage-output MAX5183 (U1)
2-3	2-3	Buffered outputs from amplifier MAX4108 (U2, U4)

Table 4. Alternate Output Drive (OUT2N, OUT2P) Selection

JU6 POSITION	JU7 POSITION	OUT2N, OUT2P PADS
1-2	1-2	Direct DAC outputs for voltage-output MAX5183 (U1)
2-3	2-3	Buffered outputs from amplifier MAX4108 (U3, U5)

Board Layout

The EV kit is a 4-layer board design (Table 6), optimized for high-speed signals. The EV kit board uses FR4 epoxy dielectric material with a relative dielectric constant of ε_r = 4.2 to 4.9. A proper FR4 design requires 14mils foil thickness for each 1oz copper layer and 0.1mm dielectric thickness between the layers. All high-speed signals are routed through 50Ω impedance-matched transmission lines. The line width for these signal lines is 14mils, with a ground plane height of 8mils. The MAX5183 EV kit has a total board thickness of 0.062in (1.57mm), using four copper layers.

The board layout separates the analog and digital portions of the circuit. Matched 50Ω impedance transmission lines are used for all high-speed digital inputs. The digital inputs are arranged in a half circle to match the line lengths between DAC inputs and the pattern and clock generators' SMA connectors. The lengths of these 50Ω transmission lines are matched to within 50mils to minimize layout-dependent data skew.

Wherever large ground planes are used, care is taken to ensure that the analog planes do not overlap with any digital planes. This eliminates the possibility of capacitively coupling digital noise through the circuit board to sensitive analog areas.

Table 5. Evaluating All Dual, 8-Bit/10-Bit DACs in the MAX518x Family

DEVICE INSTALLED ON THE EV KIT	R35, R36, R41, R42, R43
MAX5180	Installed
MAX5182	Installed
MAX5183*	Not installed
MAX5185	Not installed
MAX5186	Installed
MAX5188	Installed
MAX5189	Not installed
MAX5191	Not installed

**As shipped*

Table 6. EV Kit PC Board Layers

LAYER	DESCRIPTION
Layer I, Top	Components, jumpers, SMA connectors, digital 50Ω microstrip lines, 50Ω termination resistors, DVDD, VCC
Layer II, Digital Ground Plane	Digital ground, DGND
Layer III, Analog Ground Plane	Analog ground, AGND
Layer IV, Bottom	Components, 50Ω termination resistors, AVDD, VEE

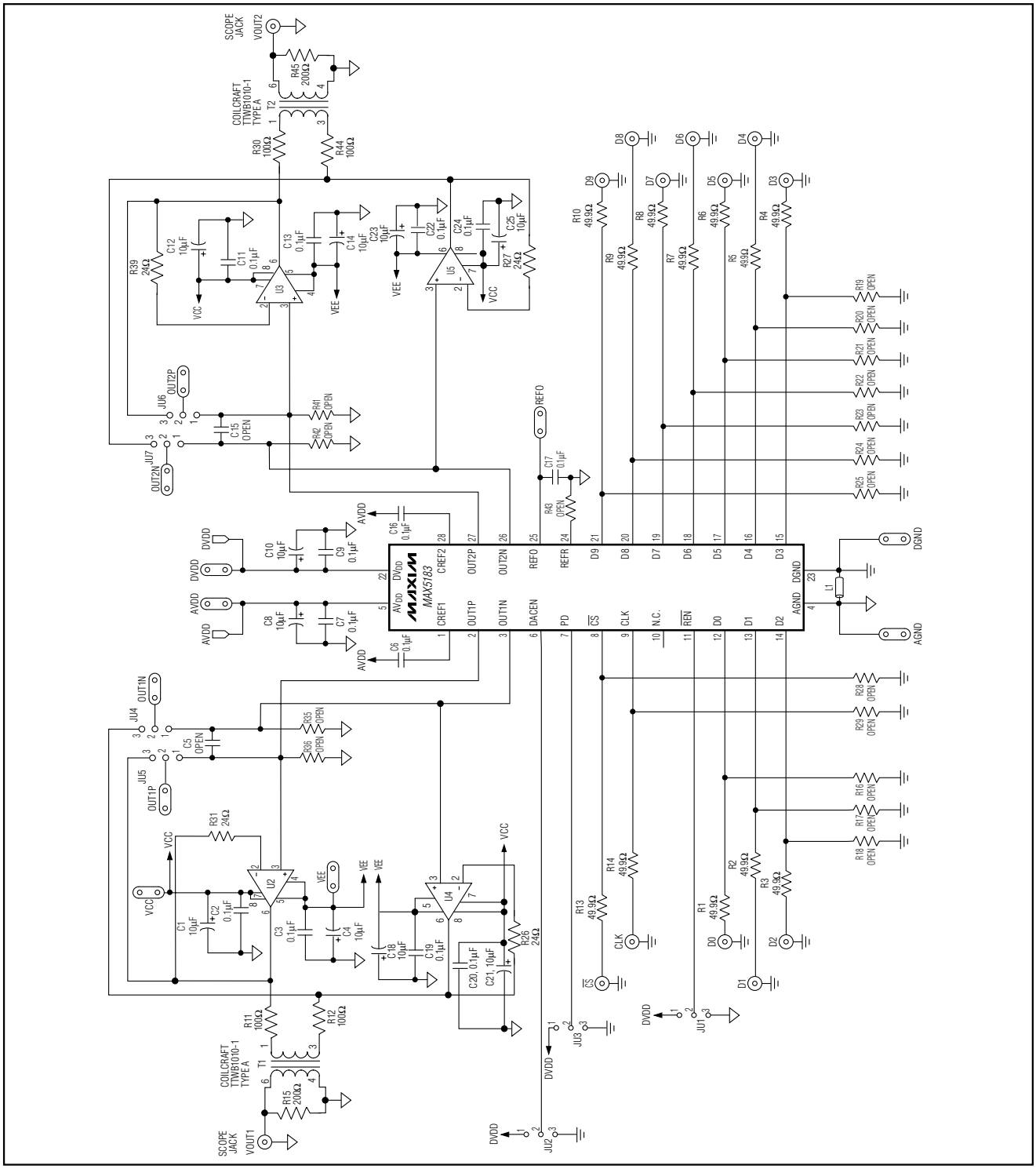

Figure 2. MAX5183 EV Kit Schematic

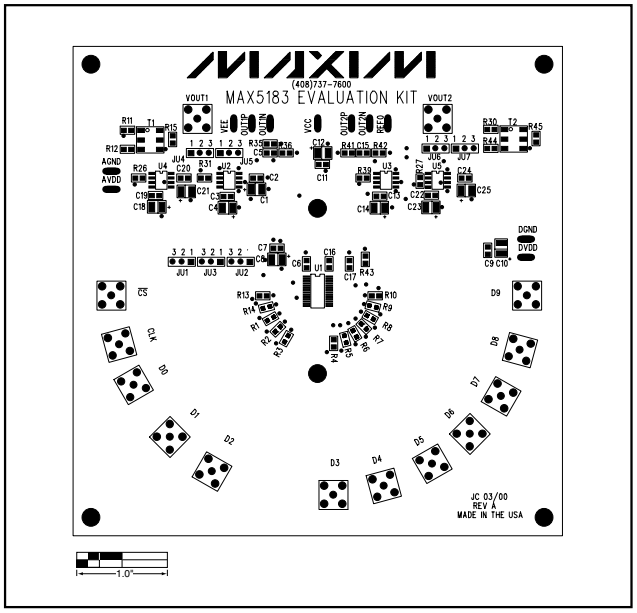

Figure 3. MAX5183 EV Kit Component Placement Guide—Component Side

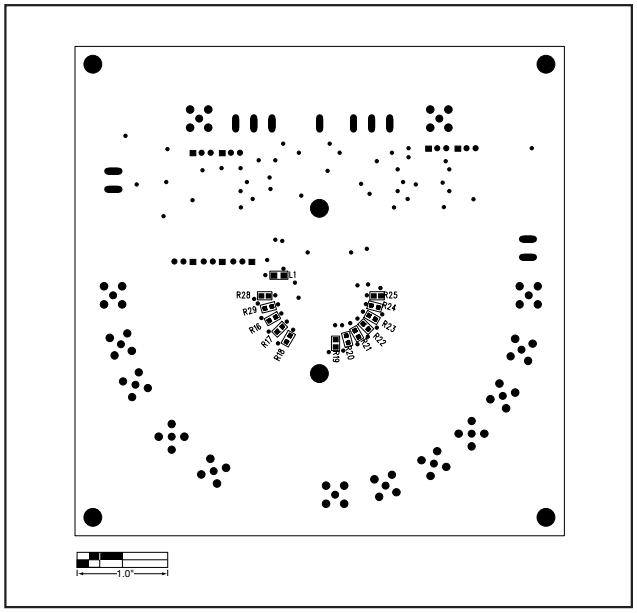

Figure 4. MAX5183 EV Kit Component Placement Guide—Solder Side

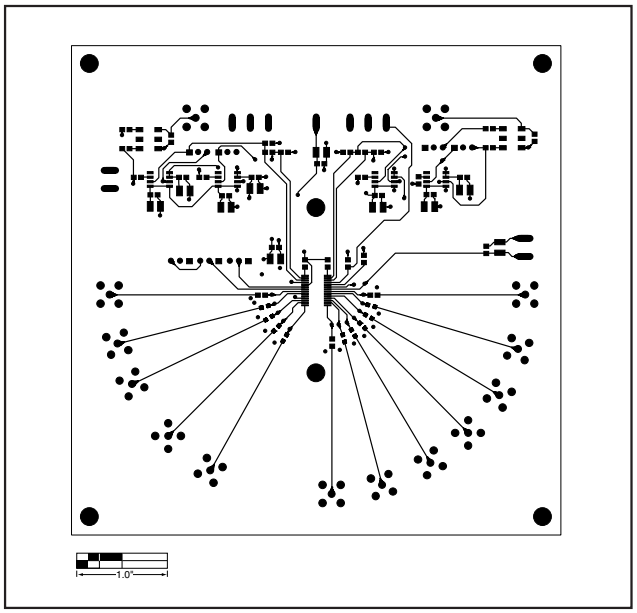

Figure 5. MAX5183 EV Kit PC Board Layout—Component Side (Layer I)

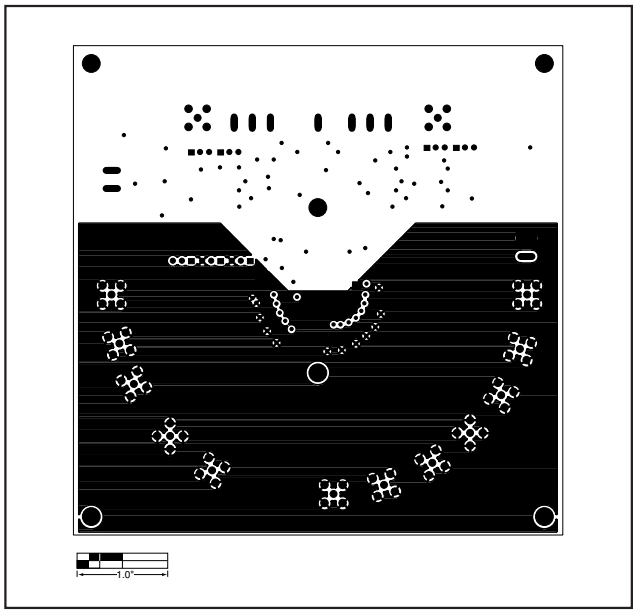

Figure 6. MAX5183 EV Kit PC Board Layout—DGND Plane (Layer II)

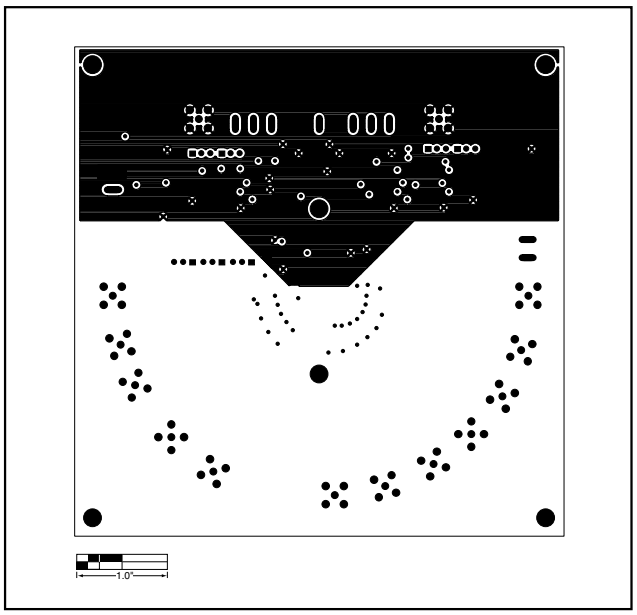

Figure 7. MAX5183 EV Kit PC Board Layout—AGND Plane (Layer III)

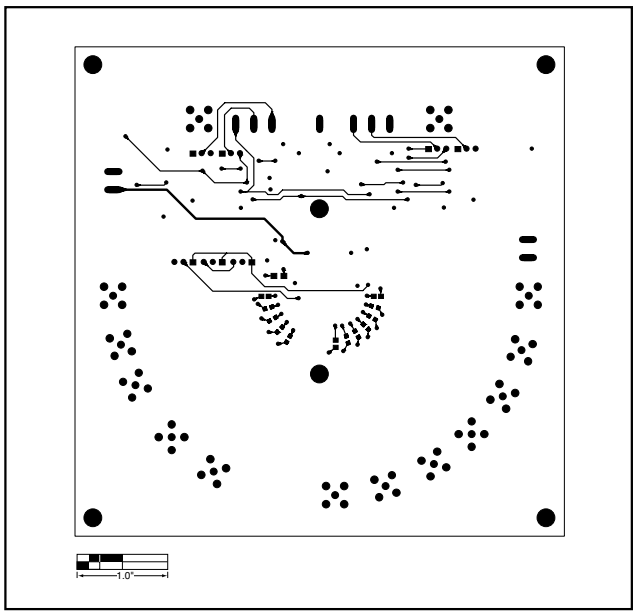

Figure 8. MAX5183 EV Kit PC Board Layout—Solder Side (Layer IV)

NOTES

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