19-4042; Rev 0; 2/08

MAX8680 Evaluation Kit

Evaluates: MAX8680

General Description

The MAX8680 evaluation kit (EV kit) is a fully assembled and tested printed-circuit board (PCB) that evaluates the MAX8680 power-management IC. The MAX8680 accepts an input from 2.7V to 5.5V and provides a complete power-supply solution for digital still cameras (DSCs) and digital video cameras (DVCs). It integrates seven on-chip power MOSFET DC-DC converters, with up to 95% efficiency to power all critical power supplies in DSC systems. All step-up converters also feature True Shutdown™, as well as internal compensation, to minimize external component count.

Ordering Information

PART	TYPE
MAX8680EVKIT+	EV Kit

+Denotes lead-free and RoHS-compliant.

Features

- ♦ **95% Efficient Synchronous-Rectified DC-DC Converters**
- ♦ **90% Efficient Buck-Boost Operation**
- ♦ **85% Efficient DC-DC Converters for CCD, LCD, WLED, and/or OLED**
- ♦ **Internal Compensation on All Channels**
- ♦ **True Shutdown on All Step-Up Converters**
- ♦ **Overload Protection**
- ♦ **Soft-Start for Controlled Startup Current**
- ♦ **Dropout Operation (100% Duty Cycle) on All Step-Down Converters**
- ♦ **Regulated Current Output for Up to 6 White LEDs**
- ♦ **PWM Dimming of WLED Current**
- ♦ **Adjustable LED Overvoltage Protection Up to 27V**
- ♦ **Transformerless Inverter for CCD**
- ♦ **2MHz Switching Frequency for Low-Voltage Channels**
- ♦ **1µA Shutdown Supply Current**
- ♦ **Power-On Voltage Tracking for Core and Main Outputs**
- ♦ **All Internal Power MOSFETs**
- ♦ **$\overline{\text{SDOK}}$ Power-OK Indicator**
- ♦ **40-Pin, 5mm x 5mm x 0.8mm Thin QFN Package**
- ♦ **Fully Assembled and Tested**

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C4	4	22µF ±10%, 6.3V X5R ceramic capacitors (1206) AVX 12066D226KAT KEMET C1206C226K9PAC Taiyo Yuden JMK316BJ226KL
C5, C11, C18	3	1µF ±10%, 6.3V X5R ceramic capacitors (0603) Murata GRM188R60J105K
C6, C7, C9, C10, C12, C13	6	10µF ±10%, 6.3V X5R ceramic capacitors (1206) AVX 12066D106KAT KEMET C1206C106K9PAC Taiyo Yuden JMK316BJ106KD
C8	1	10µF ±10%, 6.3V X5R ceramic capacitor (0805) TDK C2012X5R0J106K Murata GRM219R60J106K
C14, C16	2	1µF ±10%, 6.3V X5R ceramic capacitors (0402) Murata GRM155R60J105K
C15	1	3.3µF ±20%, 16V tantalum capacitor (3216) NEC/TOKIN PSLAIC335M Murata GRM216R61E105K
C17	1	2.2µF ±10%, 25V X5R ceramic capacitor (0805) Murata GRM219R61E225K
C19	1	4.7µF ±10%, 10V X5R ceramic capacitor (0805) Murata GRM219R61A475K
C20, C21	2	0.1µF ±10%, 10V X5R ceramic capacitors (0402) TDK C1005X5R1A104K
C22	0	Not installed, capacitor (0402)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
D1, D2, D3	3	40V, 500mA Schottky diodes (SOD123) Central Semiconductor CMHSH5-4
D4, D5	0	Not installed, white LEDs
D6–D9	4	Surface-mounted white LEDs Nichia NSCW215T
JU1, ONBST, ONINV, ONLED, ONM, ONSD, ONSU, ONZ	8	2-pin headers
JU2–JU7	0	Not installed, jumpers JU2, JU4, and JU7 are PCB trace (short); JU3, JU5, and JU6 are open
L1	1	2µH inductor, 2.33A, 28mΩ TOKO D62LCB A918CY-2R0M
L2–L4, L7	4	4.7µH inductors, 1.3A, 70mΩ TOKO DE2818C 1072AS-4R7M
L5	1	10µH inductor, 0.95A, 150mΩ TOKO DE2818C 1072AS-100M
L6	1	3.3µH inductor, 1.6A, 50mΩ TOKO DE2818C 1072AS-3R3M

DESIGNATION	QTY	DESCRIPTION
R1	1	402kΩ ±1% resistor (0402)
R2, R6, R8, R10, R12, R14	6	100kΩ ±1% resistors (0402)
R3	1	23.2kΩ ±1% resistor (0402)
R4	1	10kΩ ±1% resistor (0402)
R5	1	80.6kΩ ±1% resistor (0402)
R7	1	150kΩ ±1% resistor (0402)
R9	1	1.6MΩ ±1% resistor (0402)
R11	1	1.40MΩ ±1% resistor (0402)
R13	1	604kΩ ±1% resistor (0402)
R15	1	10Ω ±1% resistor (0603)
R16	1	100kΩ ±1% resistor (0402)
R17	1	100Ω ±1% resistor (0603)
U1	1	Power-management IC (40-pin thin QFN-EP, 5mm x 5mm x 0.8mm) Maxim MAX8680ETL+
—	1	PCB: MAX8680 Evaluation Kit+

Component Suppliers

SUPPLIER	PHONE	WEBSITE
AVX Corp.	843-448-9411	www.avx.com
Central Semiconductor Corp.	631-435-1110	www.centralsemi.com
KEMET Corp.	864-963-6300	www.kemet.com
Murata Mfg. Co., Ltd.	814-237-1431	www.murata.com
NEC/TOKIN Corp.	408-324-1790	www.nec-tokin.com
Nichia Corp.	248-349-9800	www.nichia.com
Taiyo Yuden	847-925-0888	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com
TOKO	847-297-0070	www.toko.com

Note: *Indicate that you are using the MAX8680 when contacting these component suppliers.*

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- Variable 6V power supply
- Voltmeters
- Load resistors or electronic loads

Procedure

The MAX8680 EV kit is a fully assembled and tested surface-mount board. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

1) Enable outputs VSU, VM, VSD, VSDZ, VLEDBST, VCCDBST, and VCCDINV by installing shunts on jumpers ONSU, ONM, ONSD, ONZ, ONLED, ONBST, and ONINV, respectively.
2) Verify the shunt of JU1 is installed to enable the WLED converters.
3) Preset the power supply to 3.6V. Turn the power supply off.
4) Connect the 3.6V power supply across the BATT and GND pads.
5) Turn on the 3.6V power supply.
6) Verify that the voltage across the VSU and GND pads is 5V. Connect a load, if desired, from VSU to GND. See Table 1 for output current.
7) Verify that the voltage across the VM and GND pads is 3.3V. Connect a load, if desired, from VM to GND. See Table 1 for output current.
8) Verify that the voltage across the VSD and GND pads is 1.8V. Connect a load, if desired, from VSD to GND. See Table 1 for output current.
9) Verify that the voltage across the VSDZ and GND pads is 2.5V. Connect a load, if desired, from VSDZ to GND. See Table 1 for output current.
10) Verify that the white LEDs (D6–D9) are on.
11) Verify that the voltage across the VCCDBST and GND pads is 15V. Connect a load, if desired, from VCCDBST to GND. See Table 1 for output current.
12) Verify that the voltage across the VCCDINV and GND pads is -7.5V. Connect a load, if desired, from VCCDINV to GND. See Table 1 for output current.

Table 1. Default EV Kit Output Voltages and Output Current

OUTPUT	VOLTAGE (V)	CURRENT (mA)
VSU	5	300
VM	3.3	300
VSD	1.8	250
VSDZ	2.5	200
VLEDBST	16	25
VCCDBST	15	30
VCCDINV	-7.5	100

Detailed Description

The MAX8680 EV kit provides seven DC-DC converter channels to build a multiple-output DSC power-supply system: VSU, VM, VSD, VSDZ, VLEDBST, VCCDBST, and VCCDINV. Table 1 lists the output voltages and currents for each channel. The EV kit incorporates jumpers ONSU, ONM, ONSD, ONZ, ONLED, ONBST, and ONINV to enable or disable each channel, respectively. Table 2 shows the details of the jumper functions.

Table 2. Jumper Functions

LABEL (JUMPER)	OUTPUT	SHUNT ON	SHUNT OFF
ONSU	VSU	On*	Off
ONM	VM	On*	Off
ONSD	VSD	On*	Off
ONZ	VSDZ	On*	Off
ONLED	VLEDBST	On*	Off
ONBST	VCCDBST	On*	Off
ONINV	VCCDINV	On*	Off

**Default position.*

MAX8680 Evaluation Kit

SU Step-Up Output (VSU)

The SU step-up output (VSU) powers the internal circuitry of the MAX8680 and must reach its regulation voltage (5V) before any other output is allowed to turn on. Install the shunt on jumper ONSU to enable VSU. Without VSU enabled, all outputs are shut down and the IC is in a low-current shutdown mode.

MAIN Step-Down Output (VM)

The MAIN step-down output (VM) is set to 3.3V. To enable VM, install a shunt on jumper ONM. To disable VM, remove the shunt.

SD Step-Down Output (VSD)

The SD step-down output (VSD) is set to 1.8V. To enable VSD, install a shunt on jumper ONSD on. To disable VSD, remove the shunt.

DDRZ Step-Down Output (VSDZ)

The DDRZ step-down output (VSDZ) is set to 2.5V. To enable VSDZ, install a shunt on jumper ONZ. To disable VSDZ, remove the shunt.

LEDBST Boost Output (VLEDBST)

The LEDBST boost output (VLEDBST) is capable of driving up to six white LEDs in series at up to 30mA. The EV kit comes with four surface-mounted white LEDs installed and is configured to drive the LEDs at a regulated 25mA. To protect against an open LED string, the overvoltage protection limits the maximum output voltage to 21.25V.

To enable the LED outputs, install a shunt on jumper ONLED. To disable VLEDBST, remove the shunt. Note that no current flows through the LEDs if jumper JU1 is not installed. To adjust the LED brightness or overvoltage protection, see the *Adjusting the Maximum LED Brightness and Overvoltage Protection Threshold* section.

CCDBST Boost Output (VCCDBST)

The CCDBST boost output (VCCDBST) is set to 15V. To enable VCCDBST, install a shunt on jumper ONBST. To disable VCCDBST, remove the shunt.

CCDINV Inverting Output (VCCDINV)

The CCDINV inverting output (VCCDINV) is set to -7.5V. To enable VCCDINV, install a shunt on jumper ONINV. To disable VCCDINV, remove the shunt.

Customizing the MAX8680 Evaluation Kit

Adjusting SU Step-Up Output (VSU)

The SU step-up output (VSU) is adjustable from 3.3V to 5.5V using the following procedure:

1) Choose R2 to be 100kΩ or less.
2) Solve for R1 using:

$$R1 = R2 \times [(V_{VSU}/1.01V) - 1]$$

3) Install resistors R1 and R2.

Adjusting the MAIN Step-Down Output (VM)

The input to the MAIN step-down converter is connected to VSU. The MAIN step-down output (VM) is adjustable from 1.01V to V_{VSU} using the following procedure:

1) Choose R4 to be 10kΩ or less.
2) Solve for R3 using:

$$R3 = R4 \times [(V_M/1.01V) - 1]$$

3) Install resistors R3 and R4.

Configuring the SD Step-Down Output (VSD)

The input to the SD step-down converter is connected to BATT by default. To change this connection to VSU, cut the trace shorting JU4 and short JU5.

The SD step-down output (VSD) is adjustable from 1.01V to V_{BATT} (V_{VSU}) using the following procedure:

1) Choose R6 to be 100kΩ or less.
2) Solve for R5 using:

$$R5 = R6 \times [(V_{SD}/1.01V) - 1]$$

3) Install resistors R5 and R6.

Configuring the DDRZ Step-Down Output (VSDZ)

The input to the DDRZ step-down converter is connected to VSU by default. To change this connection to BATT, cut the trace shorting JU7 and short JU6.

The DDRZ step-down output (VSDZ) is adjustable from 1.01V to V_{VSU} (V_{BATT}) using the following procedure:

1) Choose R8 to be 100kΩ or less.
2) Solve for R7 using:

$$R7 = R8 \times [(V_{SDZ}/1.01V) - 1]$$

3) Install resistors R7 and R8.

Adjusting the CCDBST Boost Output (VCCDBST)

The input to the CCDBST boost converter is connected to BATT. The CCDBST step-up output (VCCDBST) is adjustable from V_{BATT} to 18V using the following procedure:

1) Choose R12 to be 100kΩ or less.
2) Solve for R11 using:

$$R11 = R12 \times [(V_{CCDBST}/1.01V) - 1]$$

3) Install resistors R11 and R12.

Configuring the CCDINV Inverting Output (VCCDINV)

The input to the CCDINV inverting converter is connected to VBATT by default. To change this connection to VSU, cut the trace shorting JU2 and short JU3.

To adjust the VCCDINV voltage, use the following procedure:

1) Choose R14 to be 100kΩ or less.
2) Solve for R13 using:

$$R13 = R14 \times (|V_{CCDINV}|/1.25V)$$

3) Install resistors R13 and R14.

Adjusting the Maximum LED Brightness and Overvoltage Protection Threshold

Resistor R15 sets the regulation current of the LEDs as follows:

$$R15 = 0.25V/I_{LED}$$

The overvoltage protection threshold (V_{OVP}) for the LEDs is also adjustable. To ensure the LEDs are current regulated, V_{OVP} must be set higher than the maximum forward-voltage drop of the LED string plus 0.25V. Use the following procedure to set the overvoltage protection:

1) Choose R10 to be 100kΩ or less.
2) Solve for R9 using:

$$R9 = R10 \times [(V_{OVP}/1.25V) - 1]$$

3) Install resistors R9 and R10.

PWM Dimming

The ONLED input can also be driven by a logic-level PWM signal to control LED brightness. The minimum PWM frequency is 50kHz, while 0% duty cycle corresponds to zero current and 50% duty cycle corresponds to full current. With a PWM signal applied at ONLED, the FBLED voltage is regulated at 0.5V x D, where D is the duty cycle of the PWM signal. Hold ONLED low for more than 128µs to turn off the LEDBST converter.

MAX8680 Evaluation Kit

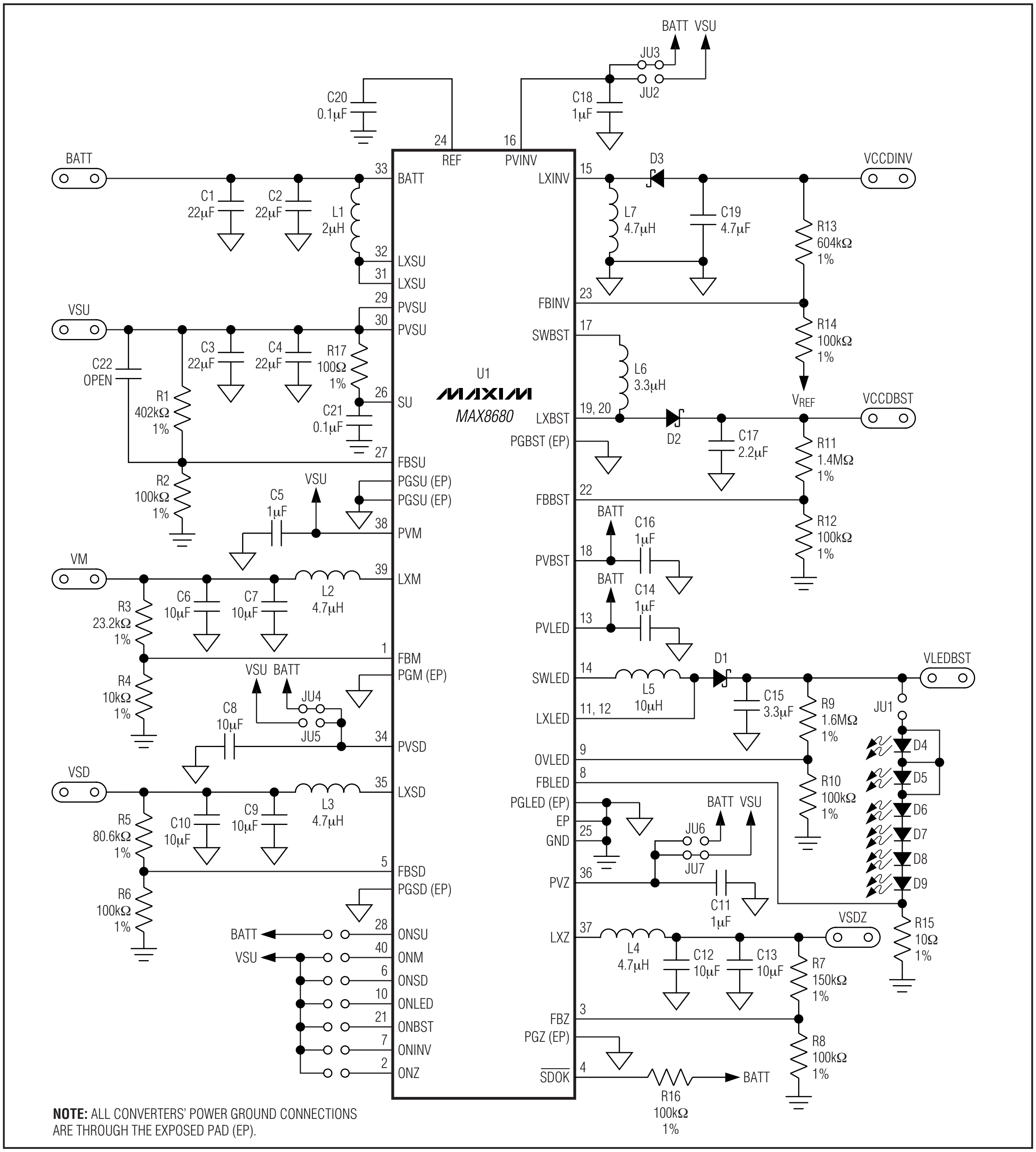

Figure 1. MAX8680 EV Kit Schematic

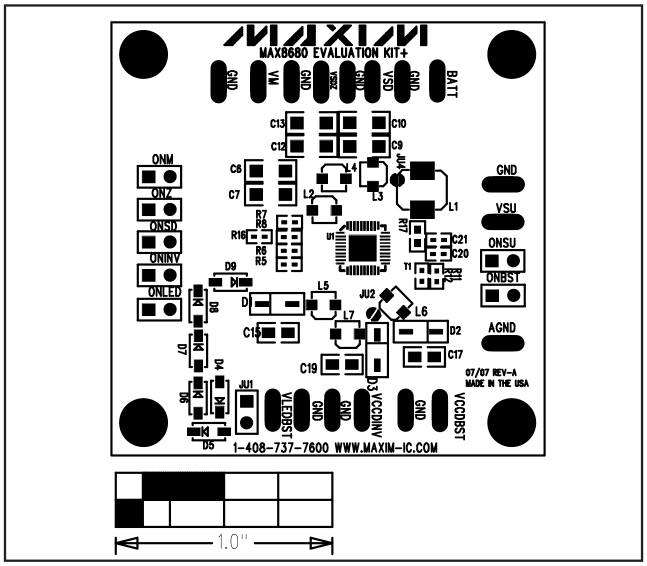

Figure 2. MAX8680 EV Kit Component Placement—Top Layer

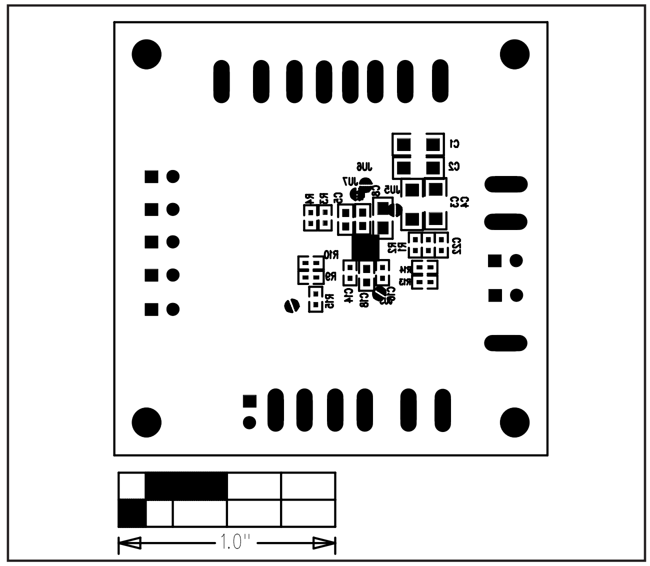

Figure 3. MAX8680 EV Kit Component Placement—Bottom Layer

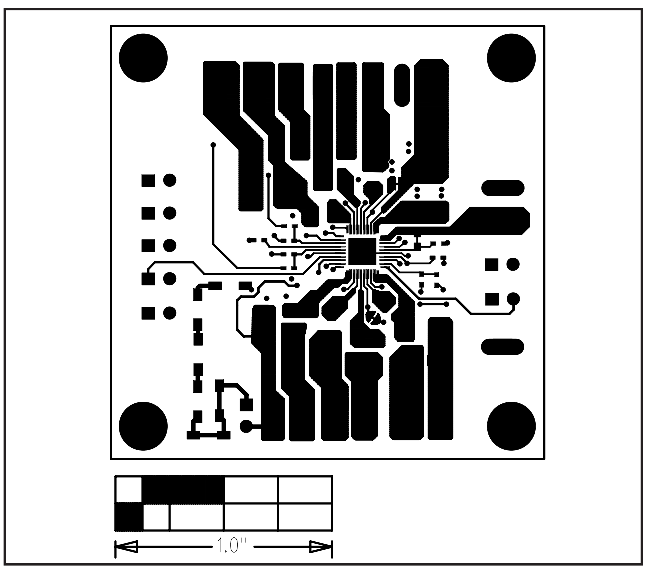

Figure 4. MAX8680 EV Kit PCB Layout—Top Layer

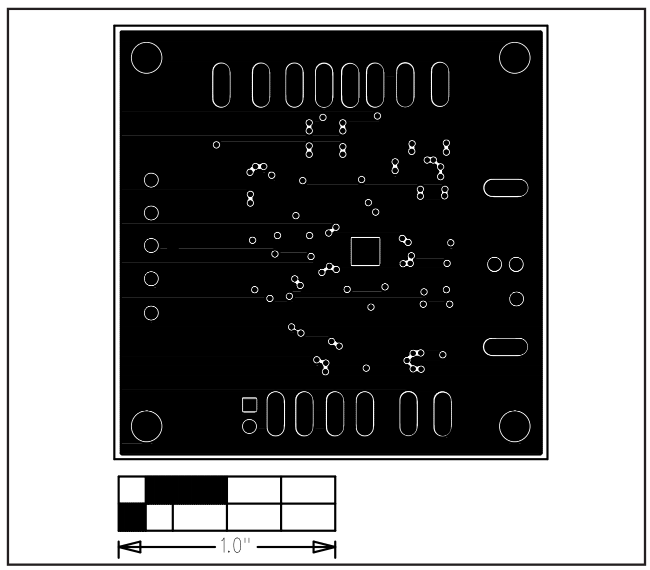

Figure 5. MAX8680 EV Kit PCB Layout—VSU Layer

MAX8680 Evaluation Kit

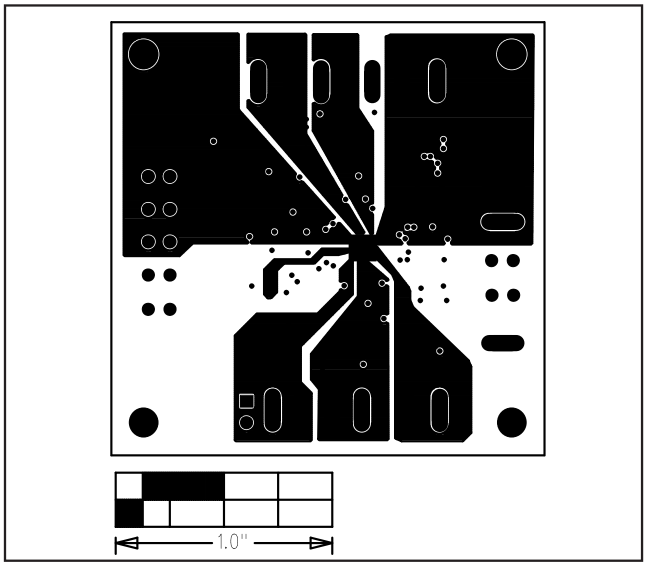

Figure 6. MAX8680 EV Kit PCB Layout—PGND Layer

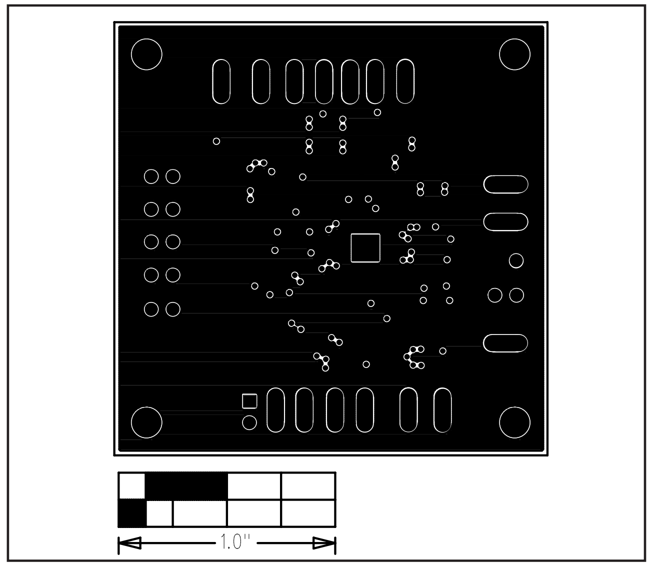

Figure 7. MAX8680 EV Kit PCB Layout—BATT Layer

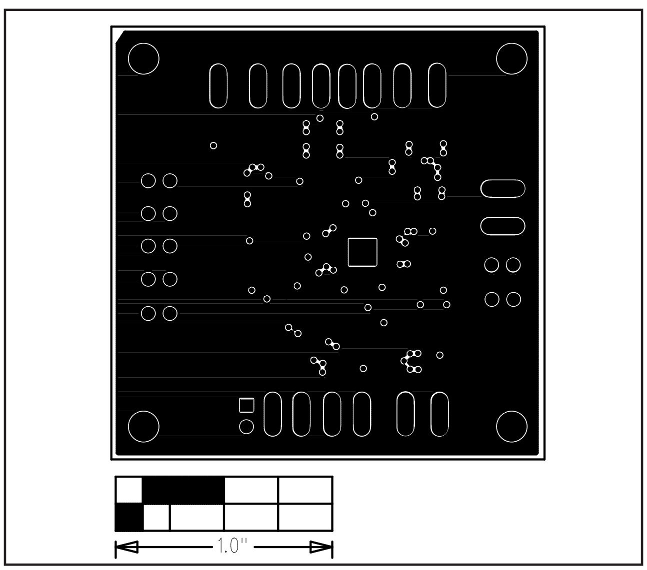

Figure 8. MAX8680 EV Kit PCB Layout—AGND Layer

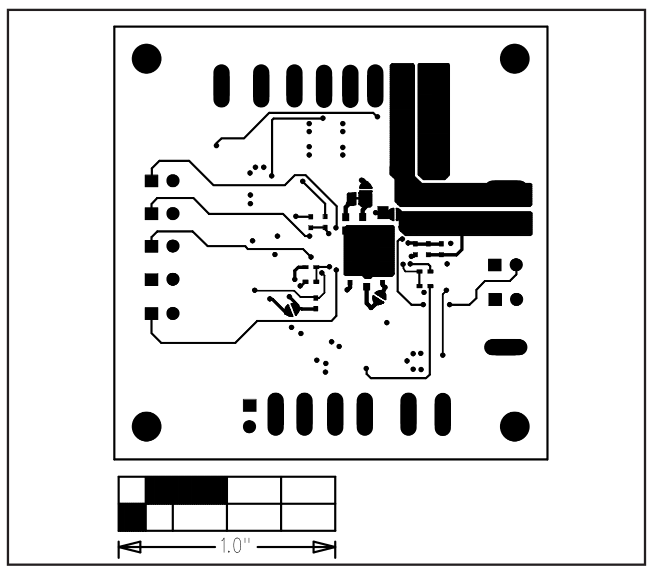

Figure 9. MAX8680 EV Kit PCB Layout—Bottom Layer