



MAX8731A Evaluation Kit/Evaluation System

General Description

The MAX8731A evaluation kit (EV kit) is an efficient, multi-chemistry battery charger. It uses the Intel system management bus (SMBus™) to control the battery-regulation voltage, charger current output, and input current-limit set point.

The MAX8731A EV kit can charge one, two, three, or four series Li+ cells with a current up to 8A. The MAX8731A evaluation system (EV system) consists of a MAX8731A EV kit and the Maxim SMBUSMON2 board. The MAX8731A EV kit includes Windows® 95/98/2000/XP-compatible software to provide a user-friendly interface.

SMBus is a trademark of Intel Corp.

Windows is a registered trademark of Microsoft Corp.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1 μ F \pm 10%, 25V X7R ceramic capacitor (0805) Murata GRM21BR71E105K TDK C2012X7R1E105K
C2, C4, C7, C17	4	0.1 μ F \pm 10%, 25V X7R ceramic capacitors (0603) KEMET C0603C104K3RAC Murata GRM188R71E104K TDK C1608JB1E104K
C3, C5, C6, C14	4	1 μ F \pm 10%, 16V X5R ceramic capacitors (0603) KEMET C0603C105K4PAC Murata GRM188R61C105K TDK C1608JB1C105K
C8, C9, C10, C19	4	0.01 μ F \pm 10%, 50V X7R ceramic capacitors (0603) KEMET C0603C103K5RAC Murata GRM188R71H103K TDK C1608JB1H103K
C11, C13, C20	3	4.7 μ F \pm 10%, 25V X5R ceramic capacitors (1210) KEMET C1210C475K3PAC Murata GRM32DR61E475K TDK C3225JB1E475K

Features

- ◆ 0.5% Battery Voltage Accuracy
- ◆ 3% Input Current-Limit Accuracy
- ◆ 3% Battery Charge-Current Accuracy
- ◆ Up to 8A Battery Charge Current
- ◆ +8V to +25V Input Voltage Range
- ◆ Charges Li+, NiCd, NiMH Battery Chemistries
- ◆ Cycle-by-Cycle Current Limiting
- ◆ SMBus-Compatible 2-Wire Serial Interface
- ◆ Includes Windows 95/98/2000/XP-Compatible Software and Demo PCB
- ◆ Fully Assembled and Tested

Ordering Information

PART	TEMP RANGE	IC PACKAGE	SMBus INTERFACE TYPE
MAX8731AEVKIT+	0°C to +70°C	28 TQFN, 5mm x 5mm	Not included
MAX8731AEVSYs+	0°C to +70°C	28 TQFN, 5mm x 5mm	SMBUSMON2

Note: The MAX8731A EV kit software is provided with the MAX8731AEVKIT+. However, to use the software, the SMBUSMON2 board is required to interface the EV kit to the computer.

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C12	1	22 μ F \pm 20%, 25V X5R ceramic capacitor (1812) TDK C4532X5R1E226M
C15, C16	0	Not installed, capacitors
C18, C22	0	Not installed, capacitors
C21	1	220pF \pm 5%, 50V C0G ceramic capacitor KEMET C0603C221J5GAC Murata GRM1885C1H221J TDK C1608C0G1H221J
D1	1	Diodes, 1N4148-type, SOD-123 Central Semiconductor CMHD4448 (top mark = C48) Diodes Inc. 1N4148W (Top Mark: T4 or T6) Fairchild Semiconductor MMSD4148 (Top Mark: 5H) Vishay Semiconductors 1N4148W-V (Top Mark: A2)
D2	1	Schottky diode, 0.5A, 30V, SOD123 Diodes Inc. B0530W (Top Mark: SE) ON Semiconductor MBR0530 (Top Mark: B3)
D3	0	Not installed
J1	1	2 x 10 right-angle female receptacle
J2, J3	0	Not installed
JU1	1	3-pin header
L1	1	4.3 μ H, 11A, 11.4m Ω inductor Sumida CEP125-4R3MC-U
LED1, LED2	2	Green LEDs (0603) Panasonic LNJ308G8TRA

DESIGNATION	QTY	DESCRIPTION
M1, M2	2	2N7002 MOSFETs, SOT23 Central Semiconductor 2N7002 (Top Mark: 702) Diodes Inc. 2N7002 (Top Mark: K72) Fairchild Semiconductor 2N7002
N1, N3	2	MOSFETs, n-channel, 9A, 30V, 8-pin SO Vishay Siliconix Si4800BDY-E3
N2	1	MOSFET with Schottky diode, n-channel, 13.5A, 30V, 8-pin SO Fairchild Semiconductor FAS66705
P1, P3–P6	5	MOSFETs p-channel -45A, -30V, $R_{DS} = 2.7\text{m}\Omega$, LPAK Renesas HAT1125H
P2	0	Not installed
R1	1	150k Ω \pm 1% resistor (0603)
R2	1	49.9k Ω \pm 1% resistor (0603)
R3, R6	2	100k Ω \pm 1% resistors (0603)
R4, R7, R10, R11, R12	5	10k Ω \pm 5% resistors (0603)
R5, R15	0	Not installed, resistors
R8	1	1 Ω \pm 5% resistor (0603)
R9	1	33 Ω \pm 5% resistor (0603)
R13, R14	2	1k Ω \pm 5% resistors (0603)
R17, R18	2	1M Ω \pm 1% resistors (0603)
R19, R20	2	100 Ω \pm 5% resistors (0603)
RS1, RS2	2	0.01 Ω \pm 1%, 1W 2512 sense resistors Vishay Dale WSL2512 0.010 \pm 1.0% IRC LRC-LRF2512-01-R010-F Panasonic ERJ-IMWSF10MU
U1	1	MAX8731AETI+, 28-pin, 5mm x 5mm Thin QFN
U2	1	CMOS analog switch, SPDT MAX4730EXT+, 6-pin SC70 (Top Mark: ABV)

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Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor	631-435-1110	www.centalsemi.com
Diodes Inc.	805-446-4800	www.diodes.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
International Resistive Co. (IRC)	361-992-7900	www.ircct.com
KEMET	864-963-6300	www.kemet.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
ON Semiconductor	602-244-6600	www.onsemi.com
Panasonic Corp.	714-373-7366	www.panasonic.com
Renesas Technology Corp.	408-382-7500	www.renesas.com
Sumida Corp.	847-545-6700	www.sumida.com
TDK Corp.	847-803-6100	www.component.tdk.com
Vishay	402-564-3131	www.vishay.com

Note: Indicate that you are using the MAX8731A when contacting these component suppliers.

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- DC source to supply the input current to the charger. This source must be capable of supplying a voltage greater than the battery-voltage set point and have sufficient current rating.
- Voltmeter
- Smart battery
- Computer running Windows 95, 98, 2000, or XP
- 9-pin serial extension cable
- SMBUSMON2 board

Procedure

The MAX8731A EV kit is a fully assembled and tested board. Follow the steps below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed. Observe all precautions on the battery manufacturer's data sheet.

- 1) Set the VPP jumper on the SMBUSMON2 board to VCC5.
- 2) Carefully connect the boards by aligning the 20-pin connector of the MAX8731A EV kit with the 20-pin header of the SMBUSMON2 board. Gently press them together.

- 3) Connect a cable from the computer's serial port to the SMBUSMON2 interface board. Use a straight-through, 9-pin, female-to-male cable.
- 4) Install the software by running the INSTALL.EXE program. The install program copies the files and creates icons for them in the Windows 95/98/2000/XP Start menu. An uninstall program is included with the software. Click on the UNINSTALL icon to remove the EV kit software from the hard drive.
- 5) Connect power to the SMBUSMON2 board.
- 6) Connect the input-current supply across the ADAPTER_IN and PGND pads.
- 7) Set jumper JU1 to position 1-2 to select battery A.
- 8) Connect a smart battery to BATT+_A, BATT-_A, THM_A, SCL, and SDA.
- 9) Turn on the power supply.
- 10) Start the MAX8731A EV kit software.
- 11) Verify current is being delivered to the battery.

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__ Detailed Description of Software

The MAX8731A program provides easy access to the MAX8731A registers. It is also capable of reading the registers of a smart battery and monitoring SMBus traffic.

Upon execution of the program, the software enables the MAX8731A smart charger command panel (Figure 1), after which any of the allowed SMBus commands can be sent to the MAX8731A. Refer to the MAX8731A data sheet for more information regarding the allowed SMBus commands.

Smart Charger Command Panel

ChargeVoltage()

To issue the ChargeVoltage() command to the MAX8731A, enter the desired voltage in millivolts into the **0x15 ChargingVoltage** edit field and select the adjacent **Write** button.

ChargeCurrent()

To issue the ChargeCurrent() command to the MAX8731A, enter the desired current in milliamps into the **0x14 ChargingCurrent** edit field and select the adjacent **Write** button.

Autorewrite Checkboxes

The MAX8731A needs to receive a ChargeVoltage() or ChargeCurrent() command every 175s (typ); otherwise, the MAX8731A times out and terminates charging. Usually, a smart battery sends these necessary commands. However, when not using a smart battery with the MAX8731A EV kit, select either (or both) of the **Auto Re-Write** checkboxes located directly under the **0x14 ChargingCurrent** and **0x15 ChargingVoltage** edit fields. This generates a ChargeVoltage() or ChargeCurrent() command at the selected time interval located on the **Timer** panel.

InputCurrent()

Input current is shown on the **Other Bitmapped Charger Registers...** panel (Figure 2). Select **0x3F:W InputCurrent** by choosing it from the pulldown list located directly under the **Other Bitmapped Charger Registers...** label. Each of the bits in the InputCurrent()

command word are shown individually with a short description of the bit and a checkbox. Select the checkboxes next to the bits for which the software should write a 1; unselect the checkboxes for a zero. Send the command to the MAX8731A by selecting the **Write** button.

Note: The default input-current-limit setting at POR is 256mA. All codes requesting input current greater than 11.004A result in an input-current overrange, limiting the input current to 11.004A.

ManufacturerID()

ManufacturerID() returns the manufacturer ID (0x004D) from the MAX8731A. This command is available through the **Other Bitmapped Charger Registers...** panel (Figure 2). Select **0xFE:R ManufacturerID** by picking it from the pulldown list located directly under the **Other Bitmapped Charger Registers...** label. Issue a ManufacturerID() command by selecting the **Read** button. The returned hexadecimal value is shown at the bottom of the panel.

DeviceID()

DeviceID() returns the device ID (0x0008) from the MAX8731A. This command is available through the **Other Bitmapped Charger Registers...** panel (Figure 2). Select **0xFF:R DeviceID** by picking it from the pulldown list located directly under the **Other Bitmapped Charger Registers...** label. Issue a DeviceID() command by selecting the **Read** button. The returned hexadecimal value is shown at the bottom of the panel.

Smart Battery Command Panel

The software is capable of reading the registers of a smart battery. The smart battery page of the software is shown in Figure 3. The software only reads the registers selected with checkmarks. By default, the registers are automatically read once every 2s. Disable this feature by unselecting the **Active Read: Battery** checkbox located on the **Timer** panel. Change the refresh time by entering a new value into the **Timer Interval** edit box and select the **Set Interval** button. When autorefresh is disabled, read the battery by selecting the **Refresh** button.

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Evaluate: MAX8731A

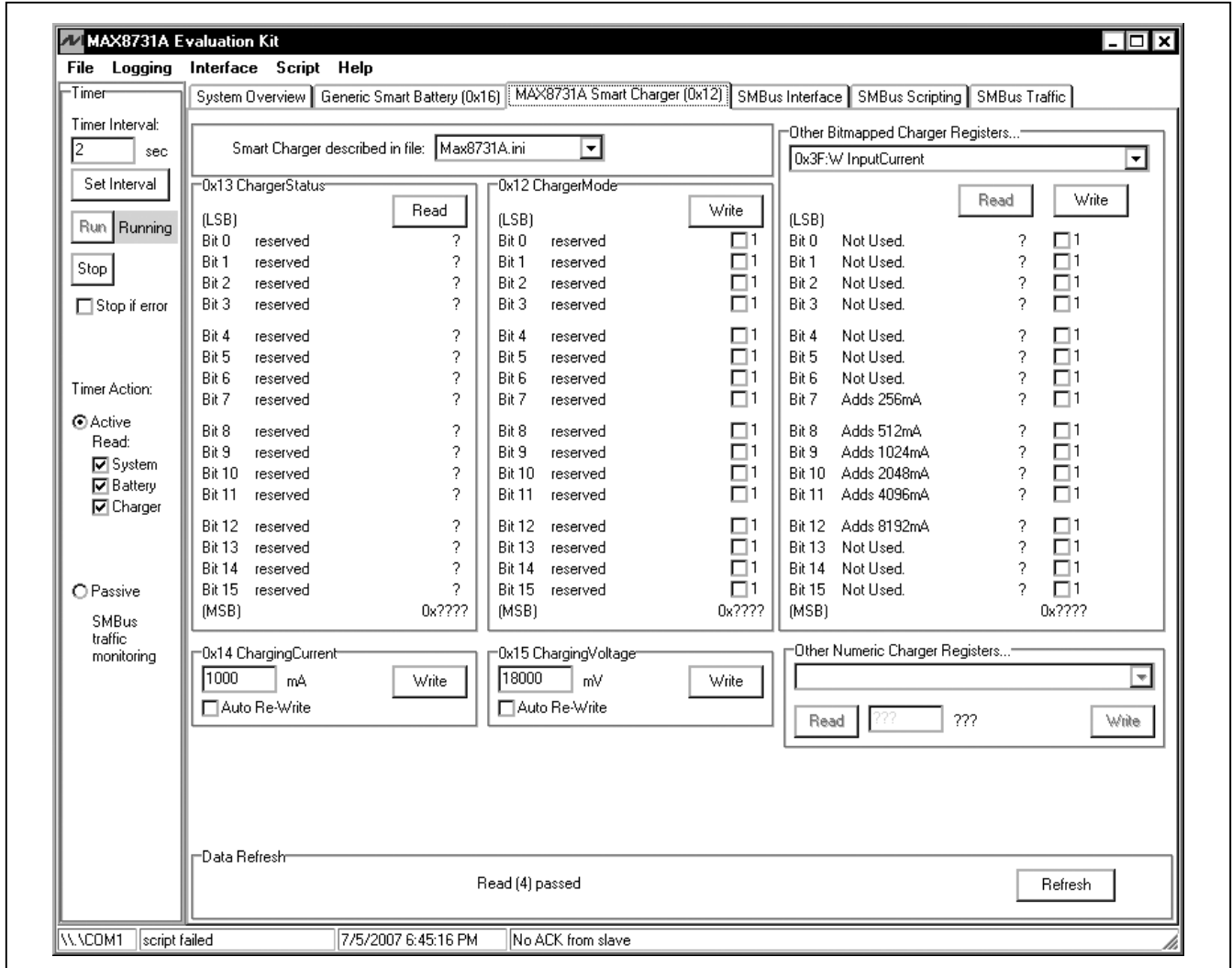


Figure 1. Smart Charger Command Panel

Detailed Description of Hardware

The MAX8731A includes all of the functions necessary to charge a smart battery. The EV kit is capable of charging with a maximum current of 8.064A and a maximum voltage of 19.2V. For more information on the operation of the MAX8731A, refer to the *Detailed Description* section of the MAX8731A IC data sheet.

Connecting a Smart Battery

The MAX8731A EV kit is capable of charging two smart batteries consecutively. Before connecting a battery, turn

off power to the EV kit. To use charger A, set jumper JU1 to position 1-2 and connect the battery to BATT+_A, BATT-_A, THM_A, SCL, and SDA. To use charger B, set jumper JU1 to position 2-3 and connect the battery to BATT+_B, BATT-_B, THM_B, SCL, and SDA.

Evaluating the MAX8731A Above 25V

To evaluate the MAX8731A with an input voltage greater than 25V (up to 28V), capacitors C1, C11, C13, and C20 must be replaced with higher voltage-rating parts.

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Evaluate: MAX8731A

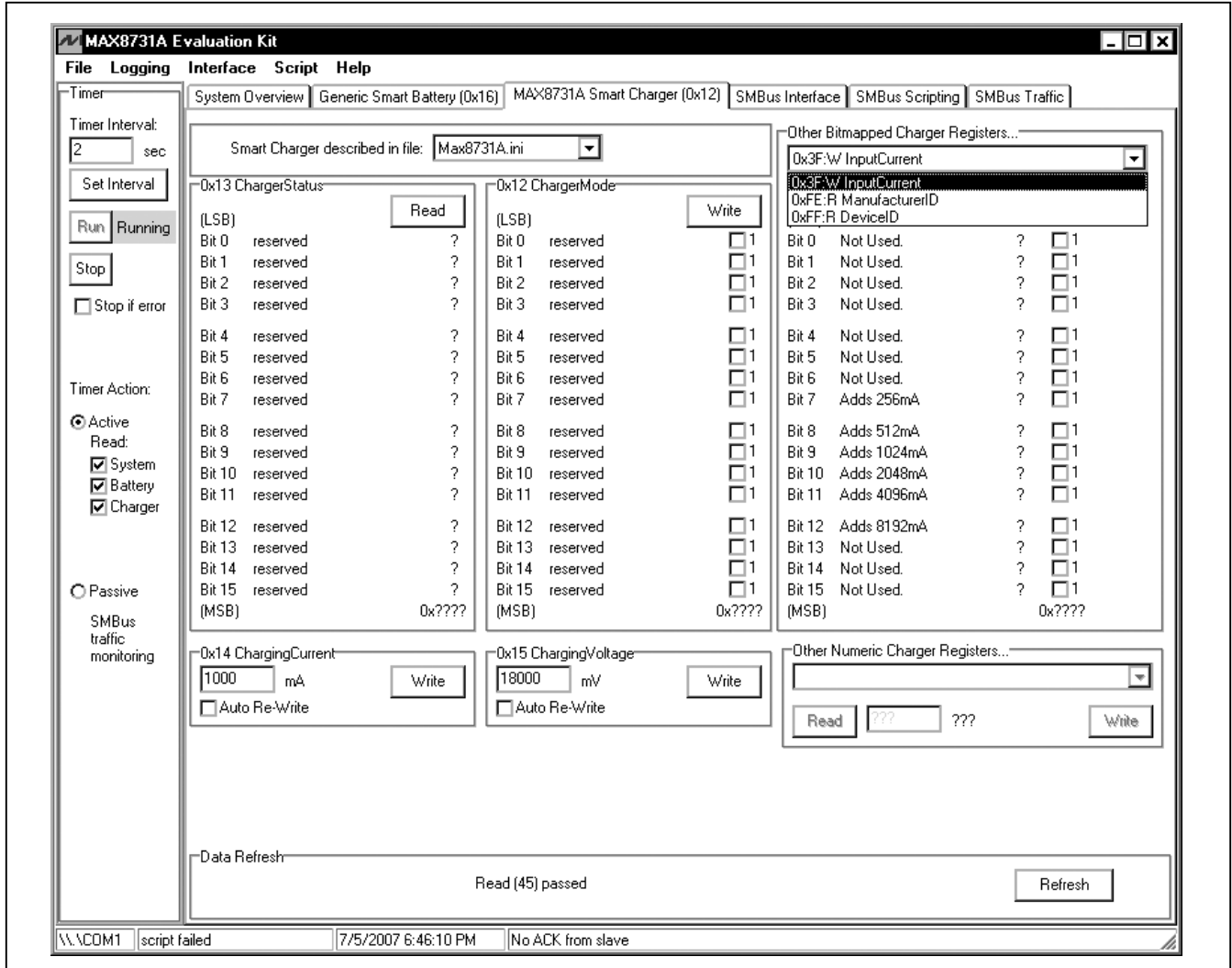


Figure 2. Smart Charger Command Panel Showing the Pull-down List for Input Current, Manufacturer ID, and Device ID

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Evaluate: MAX8731A

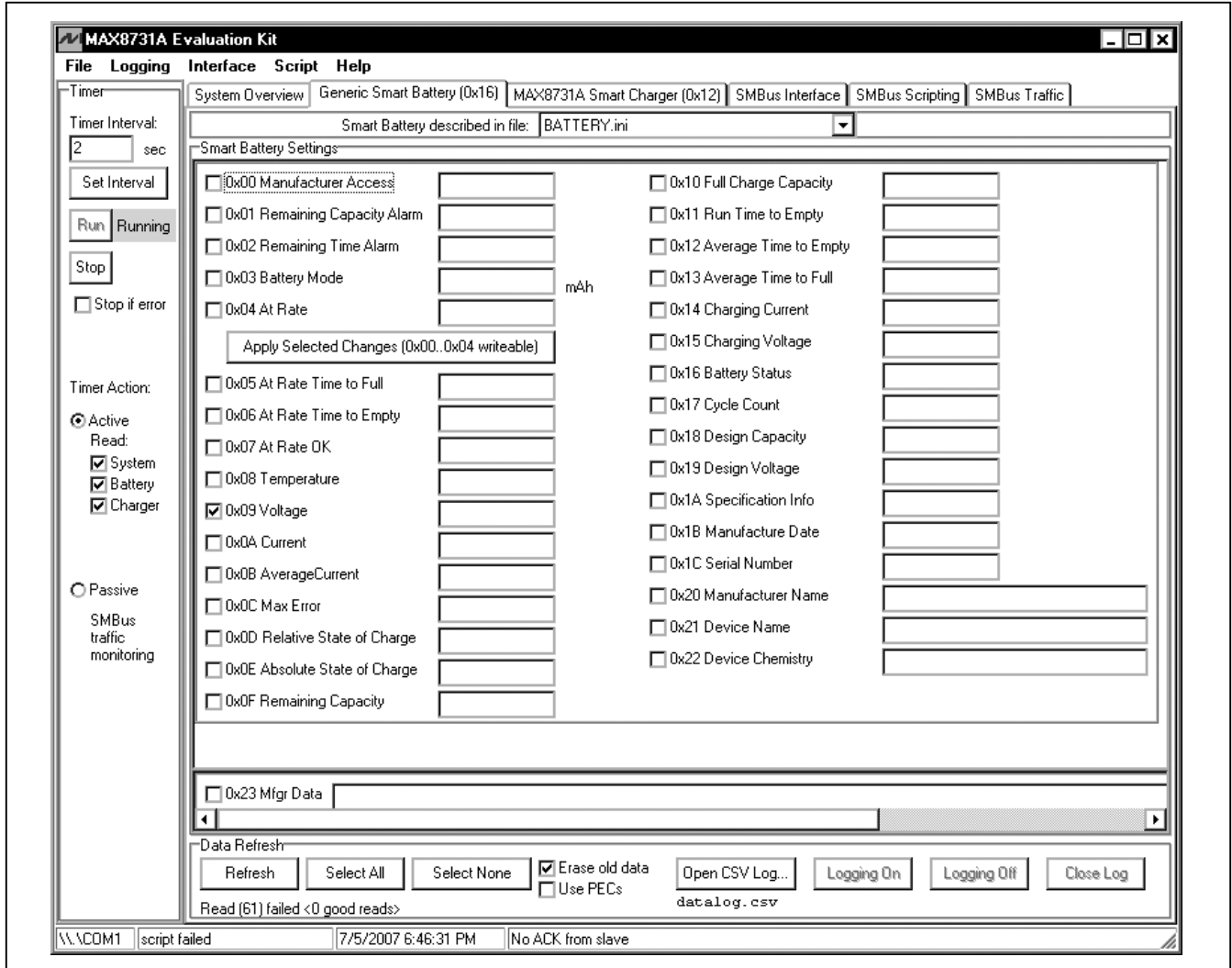


Figure 3. Smart Battery Command Panel

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Evaluate: MAX8731A

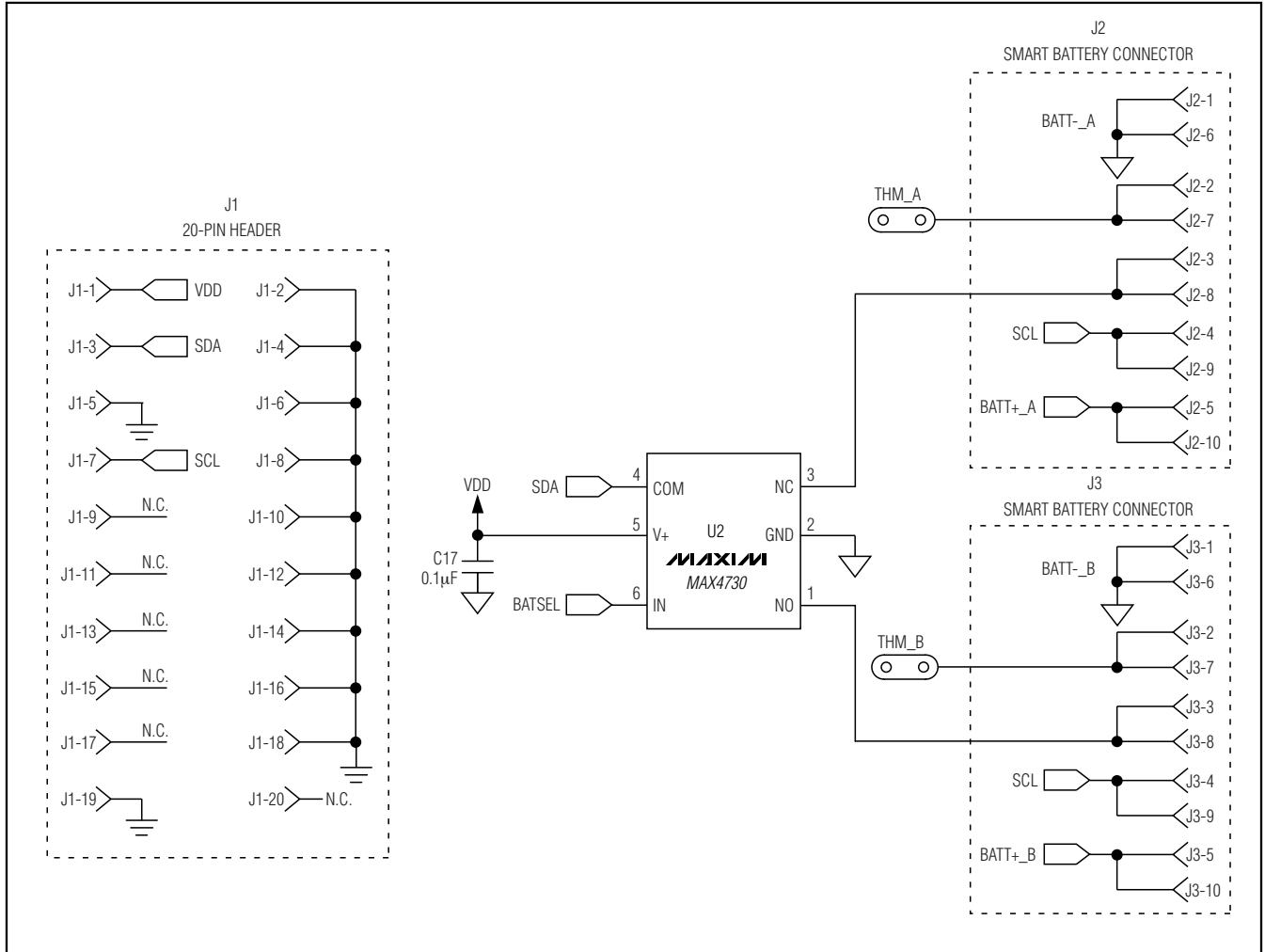


Figure 5. MAX8731A EV Kit Schematic—Smart Battery Connector

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Evaluate: MAX8731A

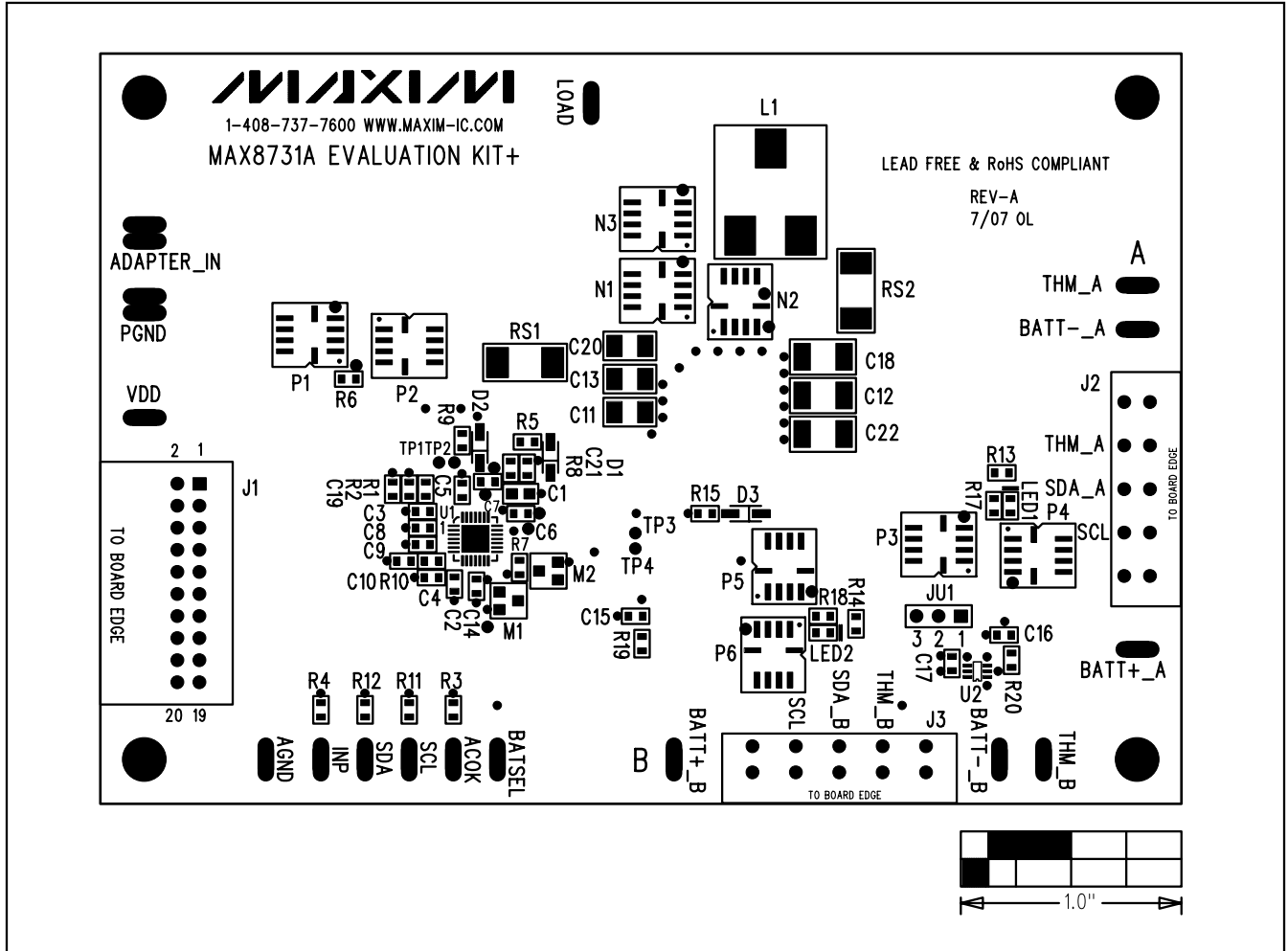


Figure 6. MAX8731A EV Kit Component Placement Guide—Component Side

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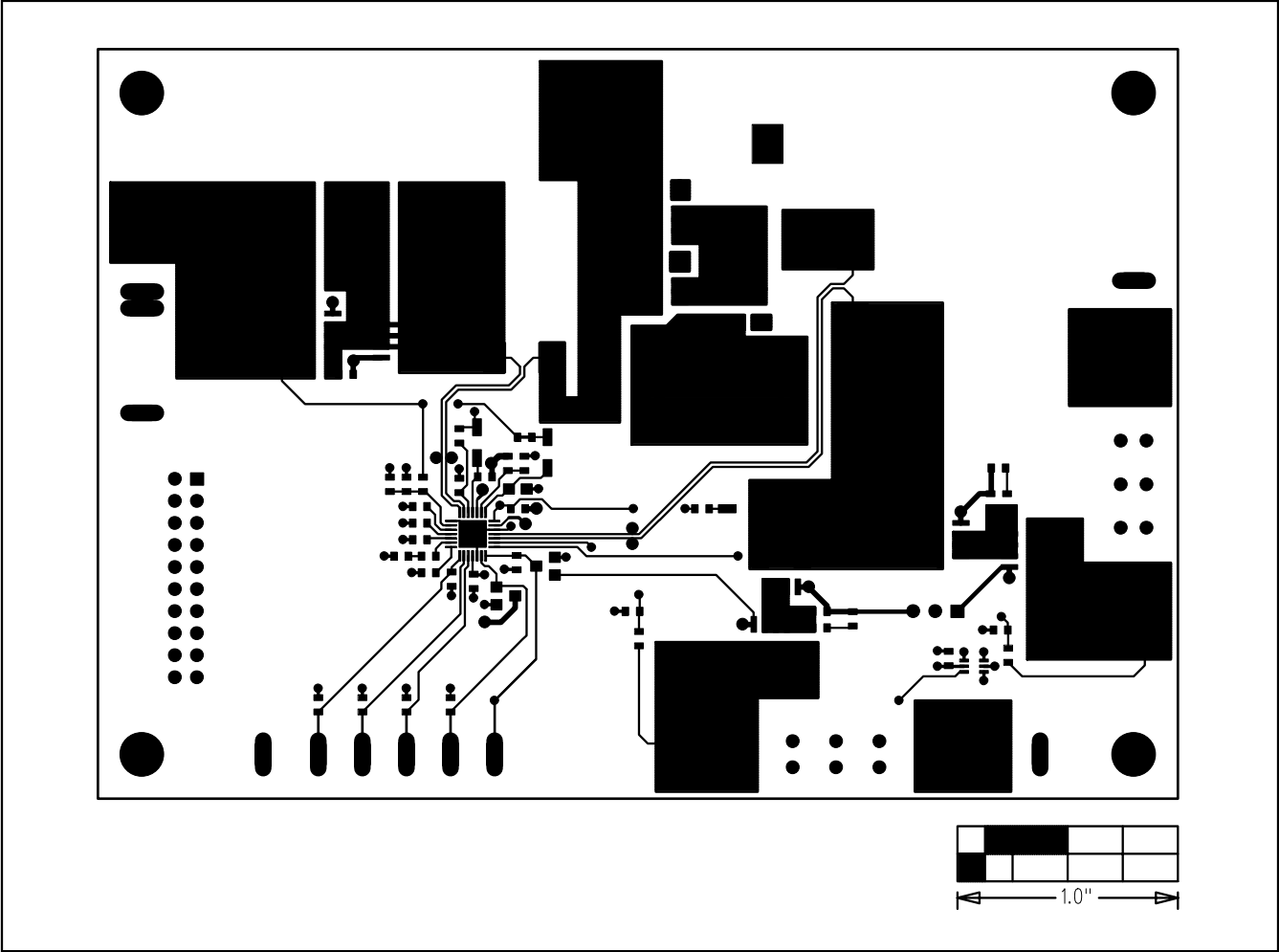


Figure 7. MAX8731A EV Kit PCB Layout—Component Side

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Evaluate: MAX8731A

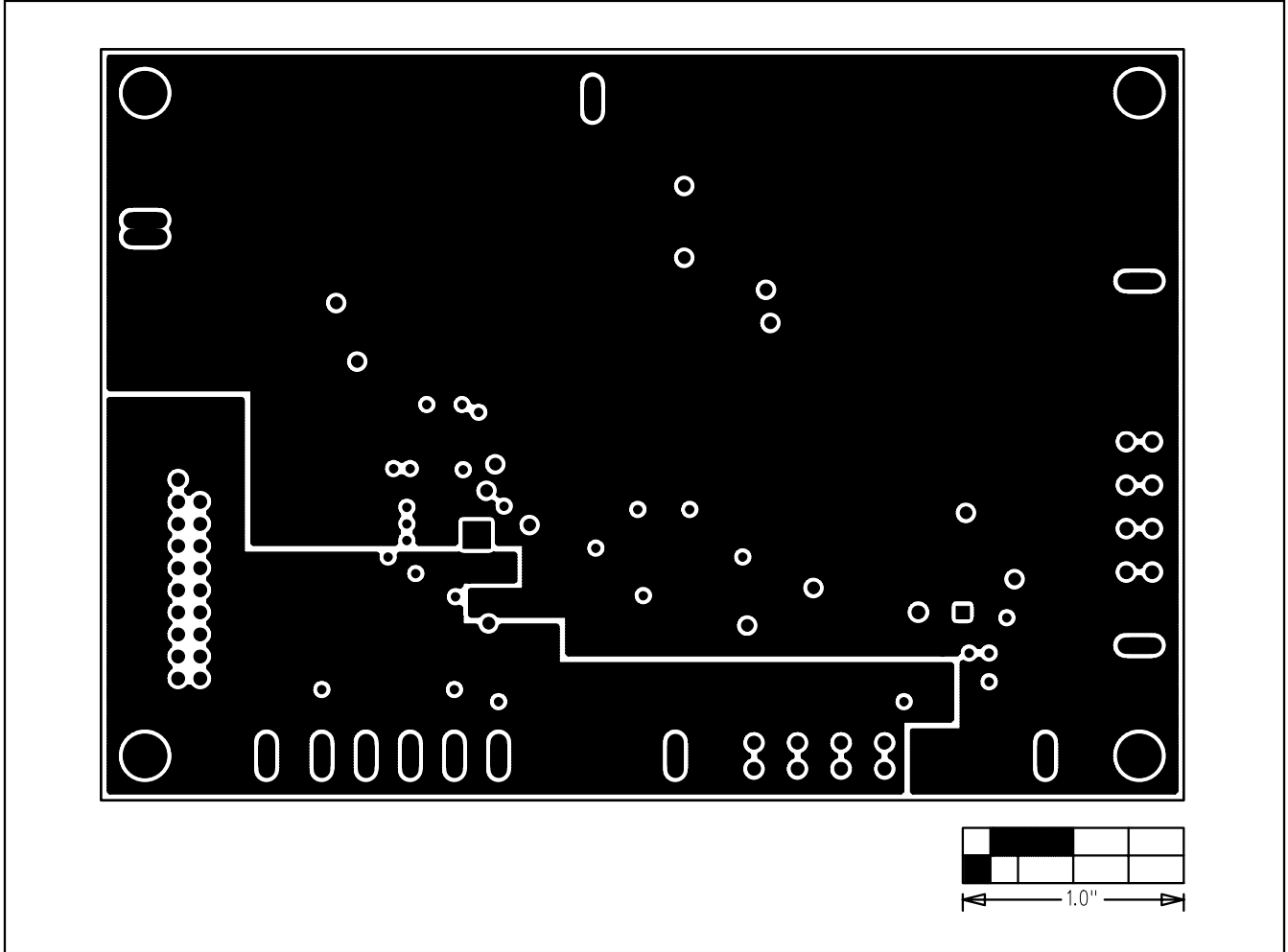


Figure 8. MAX8731A EV Kit PCB Layout—VDD and Power Ground Plane

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Evaluate: MAX8731A

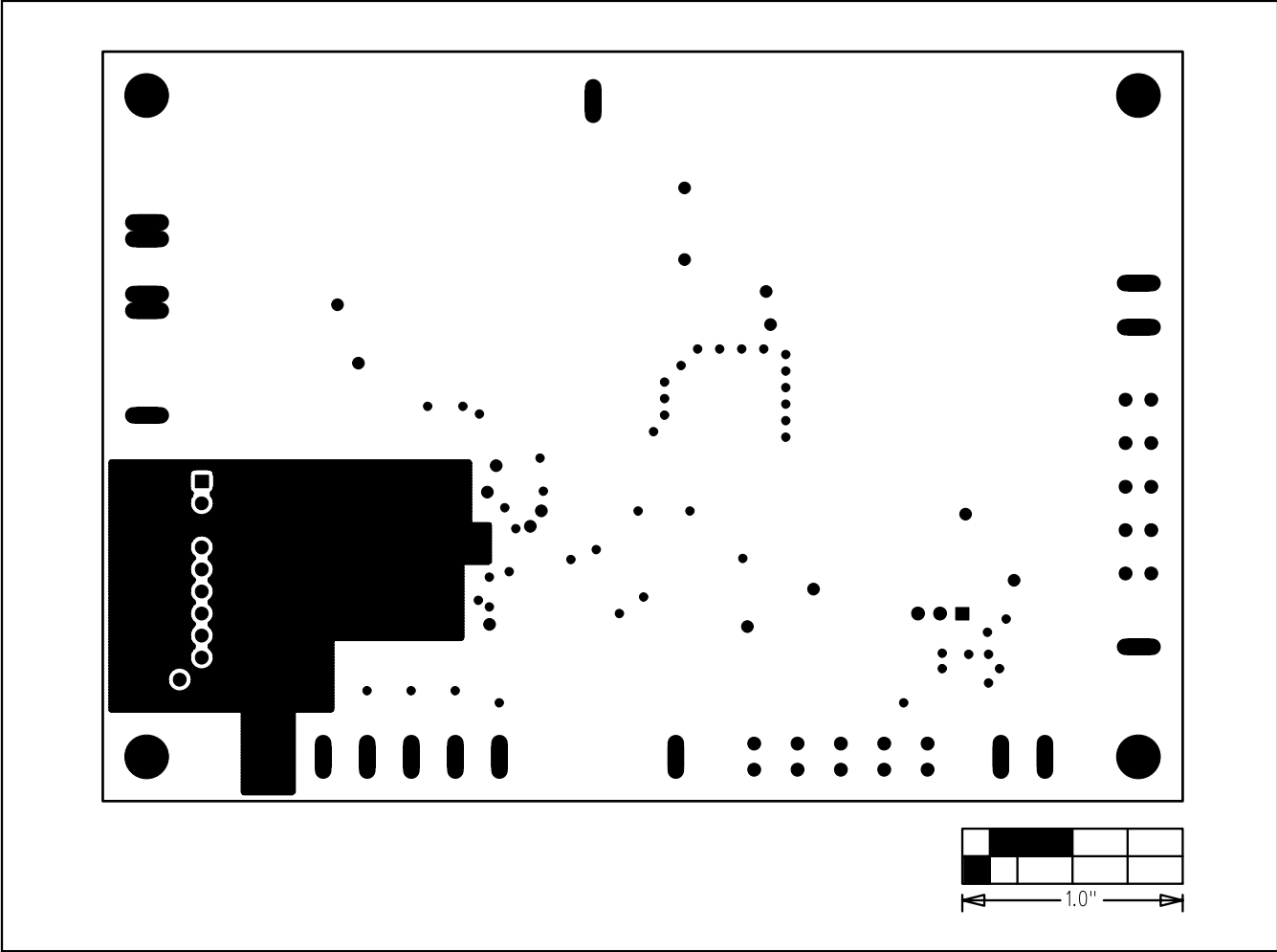


Figure 9. MAX8731A EV Kit PCB Layout—Ground Plane

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Evaluate: MAX8731A

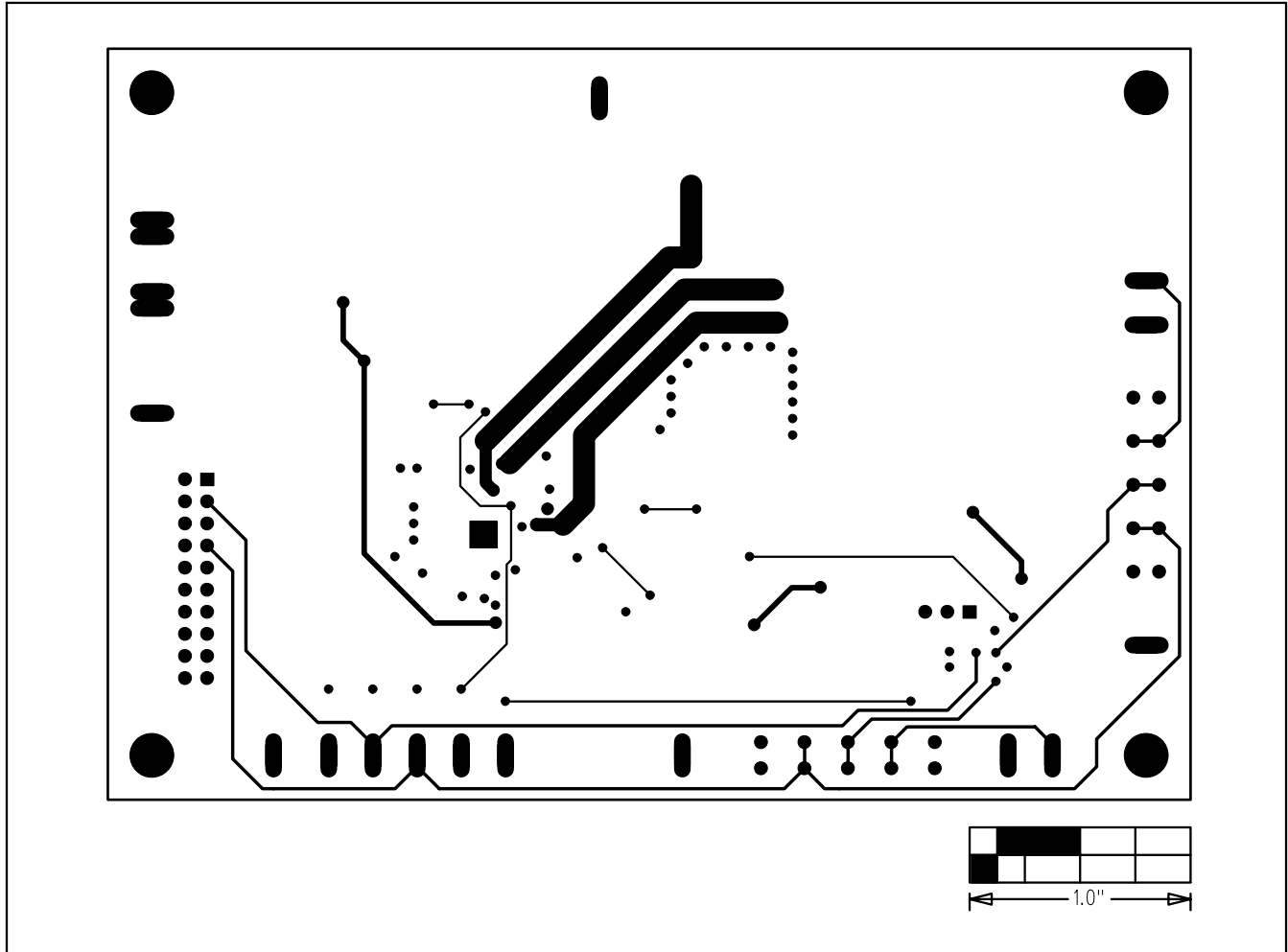


Figure 10. MAX8731A EV Kit PCB Layout—Solder Side

Revision History

Pages changed at Rev 1: Title change—all pages, 1–14

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