19-6289; Rev 0; 4/12

MAX14578A Evaluation Kit
Evaluates: MAX14578AE

General Description

The MAX14578A evaluation kit (EV kit) provides a proven design to evaluate the MAX14578AE USB battery charger detector in a 12-bump wafer-level package (WLP). The IC features charger detection compliant to USBIF battery charging spec, dedicated charger detection, Apple/Sony charger detection, China YD/T1591-compliant charger detection, and USB pass-through communication. The EV kit has various power options to separate the charging current from the system current. The EV kit features the MAX8903A 1-cell lithium-ion (Li+) DC-DC USB charger for interfacing with the MAX14578AE in an application setting.

The EV kit PCB comes with a MAX14578AEEWC+ installed.

Features

- **Includes MAX8903A USB Charger for Application Testing**
- **Can be USB Powered or Externally Powered for Greater Charging Current**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

***Ordering Information* appears at end of data sheet.**

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C7	7	0.1µF ±10%, 25V X5R ceramic capacitors (0603) Murata GRM188R61E104K
C8, C9	2	10µF ±10%, 10V X7R ceramic capacitors (0805) Murata GRM21BR71A106K
C10	1	4.7µF ±10%, 25V X5R ceramic capacitor (0805) Murata GRM21BR61E475K
C11	1	2.2µF ±10%, 6.3V X5R ceramic capacitor (0603) Murata GRM185R60J225K
CE0, CE1, CE2, DM, DP	5	White multipurpose test points
D1–D4	4	Hyper-bright, low-current red LEDs (0603)
EXTDC, LOUT, U1_BAT, U2_BAT, VB, VL, VSYS	7	Red multipurpose test points
GND	4	Black multipurpose test points
JU1, JU4, JU9, JU10	4	3-pin headers
JU2, JU7	2	4-pin headers
JU3, JU5, JU6, JU8	4	2-pin headers
L1	1	1µH, 2.2A inductor TOKO FDSD0415-1R0M
NTC	1	100kΩ NTC thermistor (0402) Murata NCP15WF104J03RC
P1	1	USB micro-B, right-angle PC-mount receptacle
P2	1	USB type-A, right-angle receptacle
R1, R2, R7	3	10kΩ ±5% resistors (0603)
R3–R6	4	2kΩ ±5% resistors (0603)
R8	1	0Ω ±5% resistor (0603)
R9, R10	0	Not installed, potentiometers
R11, R12	0	Not installed, resistors (0603)
R13	1	4.53kΩ ±1% resistor (0603)
R14	1	1.2kΩ ±1% resistor (0603)
R15	1	100kΩ ±1% resistor (0603)
U1	1	USB charger detector (12 WLP) Maxim MAX14578AEEWC+
U2	1	1-cell Li+ charger for USB and adapter power (28 TQFN-EP*) Maxim MAX8903AETI+
—	1	USB high-speed A-to-B cable (6ft)
—	1	USB high-speed A-to-micro-B cable (1m)
—	10	Shunts
—	1	PCB: MAX14578A EVALUATION KIT

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America Inc.	770-436-1300	www.murata-northamerica.com
TOKO America, Inc.	847-297-0070	www.tokoam.com

Note: *Indicate that you are using the MAX14578AE when contacting these component suppliers.*

Quick Start

Required Equipment

- MAX14578A EV kit
- Windows XP®, Windows Vista® or Windows 7 PC with a spare USB port
- USB flash memory stick
- Resistor networks, as shown in the MAX14578E/MAX14578AE IC data sheet
- Multimeter
- Wire with clips

Procedure

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

1) Verify that the jumpers on the EV kit board are in their default positions, as shown in Table 1.
2) Connect the A-to-B USB cable from the PC to the P1 USB connector on the EV kit board.
3) Measure the voltage on the LOUT test point on the EV kit. Verify that the voltage is approximately 5V.
4) Measure the voltage on the VL test point on the EV kit board. Verify that the voltage is around 5V.
5) The EV kit can detect different chargers, but many times the chargers have custom cables and connectors. The user can use wires with clips and different resistor networks to simulate different charger detection.
6) The following are three application tests. The first is for dedicated charger detection. The second is for 1A Apple charger detection. The third is for 0.5A Apple charger detection.
7) Plug a USB flash memory stick into the P2 connector.
8) Wait a few seconds and verify on your PC that the USB flash memory is visible and the content in the memory can be accessed. This is the USB transceiver pass-through communication.
9) Unplug the USB cable from the PC.
10) Using a wire with clips, electrically connect the DP and DM test points on the EV kit board.
11) Plug the USB cable to the PC again. Verify that the flash memory is not accessible.
12) Using the multimeter, verify that the voltages on the CE2, CE1, and CE0 test points on the EV kit board are 0V, 5V, and 0V, respectively. This is the dedicated charger application test.
13) Unplug the USB cable from the PC.
14) Connect a 1A Apple charger resistor network, as shown in the MAX14578E/MAX14578AE IC data sheet.
15) Plug the USB cable to the PC again. Verify that the flash memory is accessible.
16) Using the multimeter, verify that the voltages on the CE2, CE1, and CE0 test points on the EV kit board are 0V, 5V, and 0V, respectively. This is the 1A Apple charger application test.
17) Unplug the USB cable from the PC.
18) Connect a 0.5A Apple charger resistor network, as shown in the MAX14578E/MAX14578AE IC data sheet.
19) Plug the USB cable to the PC again. Verify that the flash memory is accessible.
20) Using the multimeter, verify that the voltages on the CE2, CE1, and CE0 test points on the EV kit board are 5V, 0V, and 0V, respectively. This is the 0.5A Apple charger application test.

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Detailed Description of Hardware

The MAX14578A EV kit evaluates the MAX14578AE USB charger detector. The EV kit demonstrates USB signal pass-through, charger detection and on-board charging using the MAX8903A. The EV kit has various on-board test points to monitor various signals.

The EV kit uses the MAX14578AEEWC+ in a 12-bump (1.3mm x 1.68mm) WLP on a proven four-layer PCB design. The EV kit operates off the USB supply. To test charging applications, an external power supply may be needed for high current charging.

Pass-Through Communication

The EV kit USB signal traces are designed with 90Ω differential impedances. The controlled impedances allow the EV kit to pass USB-compliance testing using eye diagrams.

Charger Detection

The EV kit detects the charger plugged into the P1 connector. The charger detection can occur without any interface to the MAX8903A charger (U2). Test points are located on the D+/D- lines (DP/DM) that connect to P1 to simulate different types of chargers.

One common charger detection method is the China YD/T1591-compliant charger, which looks for a short between D+ and D-. If that charger is not available, short the DP and DM test points with a wire and read the voltages on the charger-enable control outputs (i.e., CE2, CE1, and CE0).

Another common charger is the Apple charger. The detection involves looking for a specific voltage on the D+ and D- lines. The 1A Apple charger has approximately 2V on D+ and 2.68V on D-. Use a resistor network or directly apply the correct voltages on the DP and DM test points to simulate the charger, and measure the voltages on the charger-enable control outputs.

On-Board Charging

The U2 charger circuitry is placed on the EV kit for charging application tests. The maximum input voltage to the U2 device is 16V. For low-current charging tests, connect the USB power from the P1 USB connector (VB) to the U2 USB power input pin. For higher current charging, connect the U2 DC power input pin to the EXTDC test point, and apply a user-supplied DC power supply up to 16V.

The U2 device is set for a maximum 1.5A charging current. The current limit is set by the U1 device depending on the states of the CE2, CE1, and CE0 pins. The EV kit has a fixed current limit of 1.5A, but the EV kit layout is designed to install Vishay TSM4-series potentiometers on R9 and R10 for custom current limits.

Power Supply

The EV kit has various power options and jumpers to separate the supply current from the charging current. The EV kit is USB powered by default. The 5V comes from the P1 VBUS line and powers the inputs to both the U1 and U2 devices. U1 has an LDO with output at 5V and 100mA (LOUT test point). The total USB current is approximately 500mA, so to test more than 500mA charging current, use an external supply.

Table 1. Jumper Descriptions (JU1–JU10)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2	$\overline{EN}$ pin of U1 connected to VB (disabled).
	2-3*	$\overline{EN}$ pin of U1 connected to GND (enabled).
JU2	1-2*	DC pin of U2 connected to GND.
	1-3	DC pin of U2 connected to a user-supplied DC power.
	1-4	DC pin of U2 connected to the VB pin of U1.
JU3	1-2	CE2 pin of U1 connected to the IUSB pin of U2.
	Pin 1*	CE2 pin of U1 disconnected from the IUSB pin of U2.
JU4	1-2	$\overline{CEN}$ pin of U2 connected to VL (disabled).
	2-3*	$\overline{CEN}$ pin of U2 connected to GND (enabled).
JU5	1-2	CE1 pin of U1 connected to the DCM pin of U2.
	Pin 1*	CE1 pin of U1 disconnected from the DCM pin of U2.
JU6	1-2	CE0 pin of U1 connected to the USUS pin of U2.
	Pin 1*	CE0 pin of U1 disconnected from the USUS pin of U2.
JU7	1-2*	USB pin of U2 connected to the VB pin of U1.
	1-3	USB pin of U2 connected to a user-supplied DC power.
	1-4	USB pin of U2 connected to GND.
JU8	1-2*	BAT pin of U1 connected to the BAT pin of U2.
	Pin 1	BAT pin of U1 disconnected from the BAT pin of U2.
JU9	1-2*	USB connector P2 VBUS connected to the VB pin of U1.
	1-3	USB connector P2 VBUS connected to the LOUT pin of U1.
JU10	1-2	Charger-enable control outputs pulled up to the VL pin of U2.
	2-3*	Charger-enable control outputs pulled up to the LOUT pin of U1.

**Default position.*

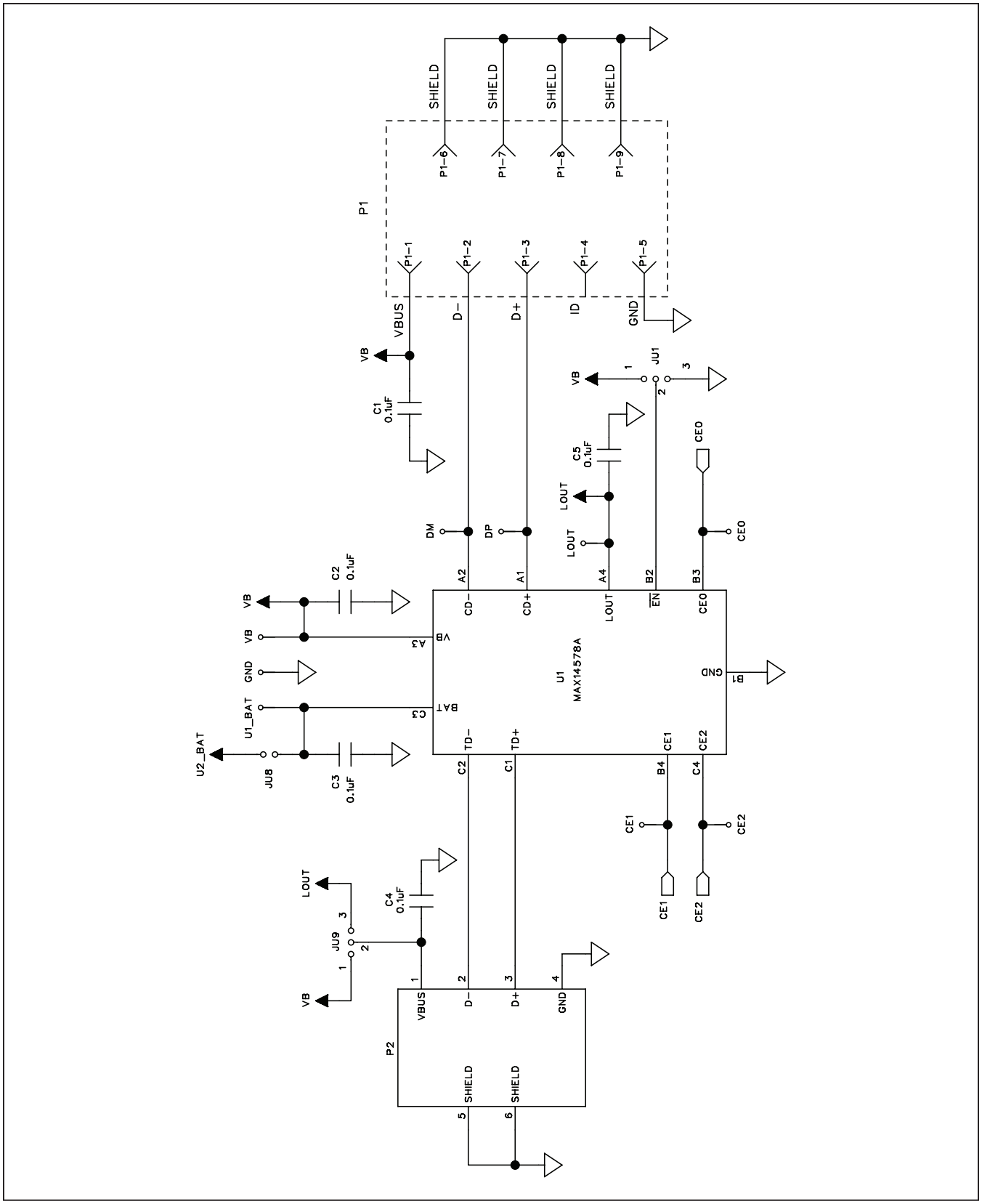

Figure 1a. MAX14578A EV Kit Schematic (Sheet 1 of 2)

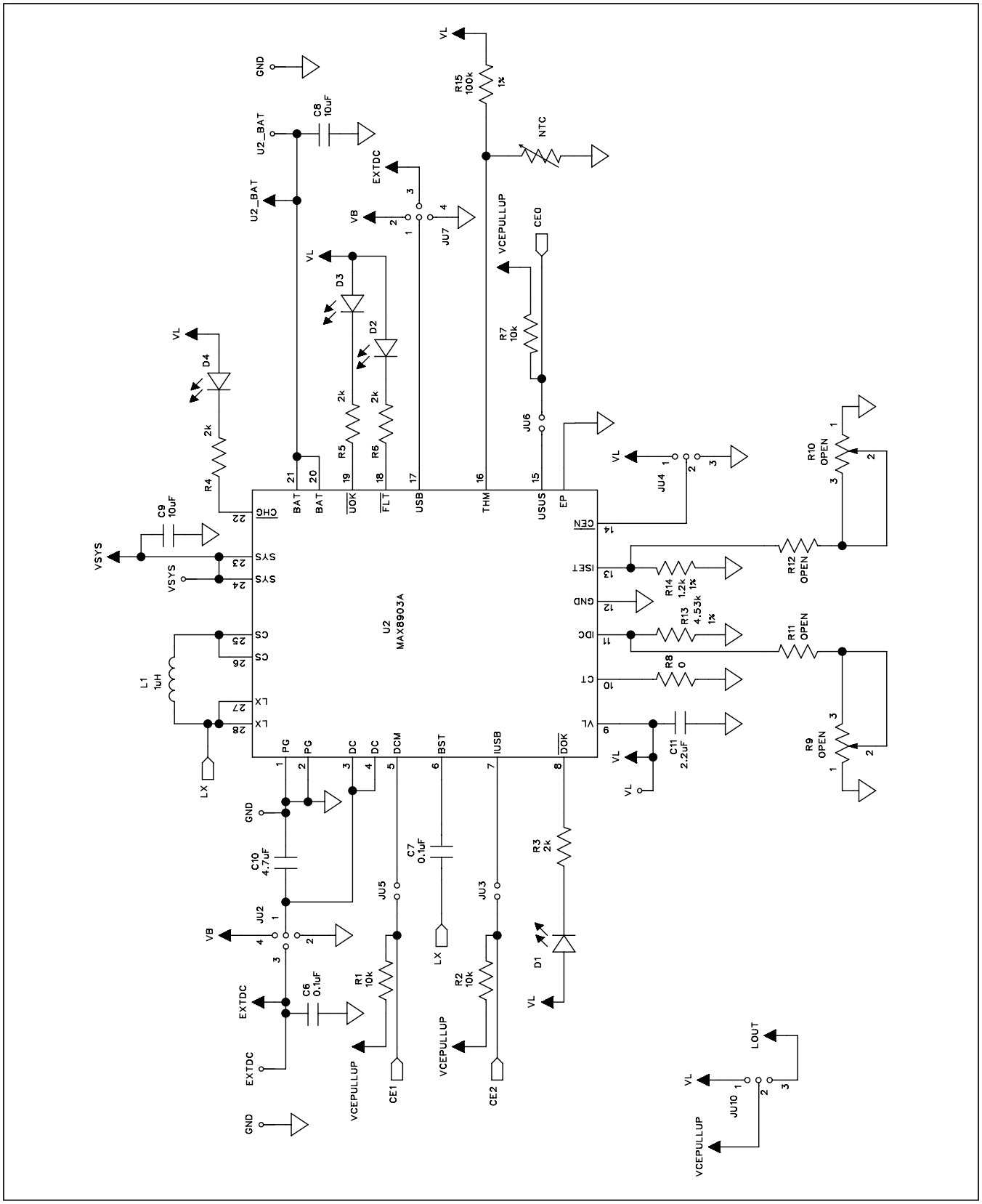

Figure 1b. MAX14578A EV Kit Schematic (Sheet 2 of 2)

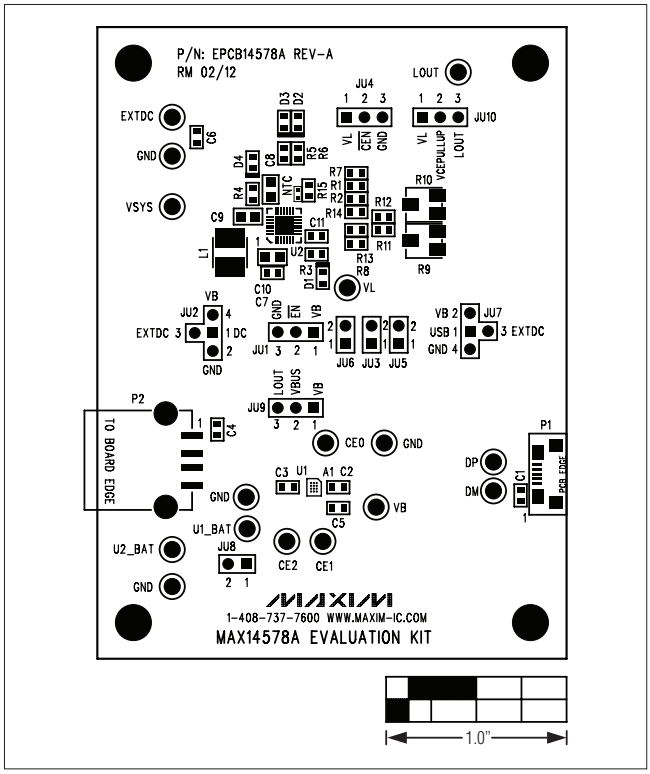

Figure 2. MAX14578A EV Kit Component Placement Guide—Component Side

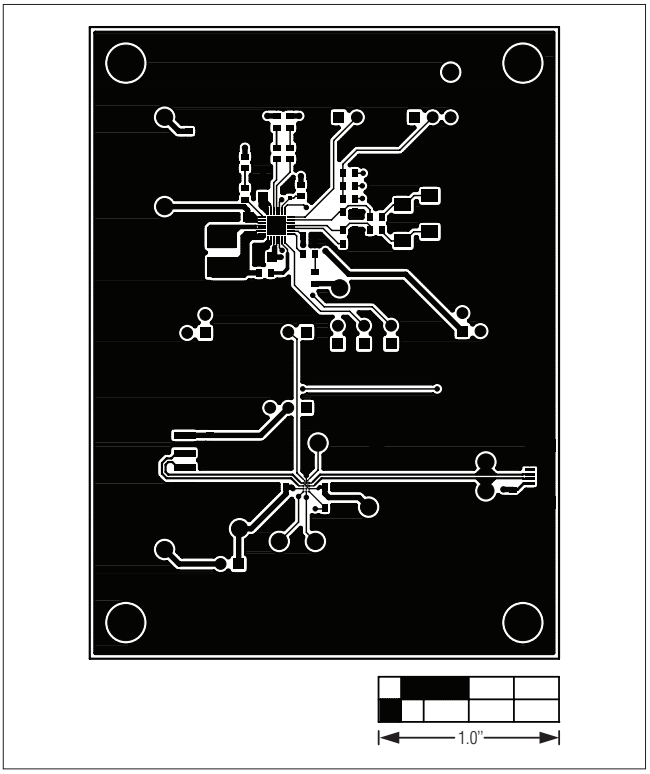

Figure 3. MAX14578A EV Kit PCB Layout—Component Side

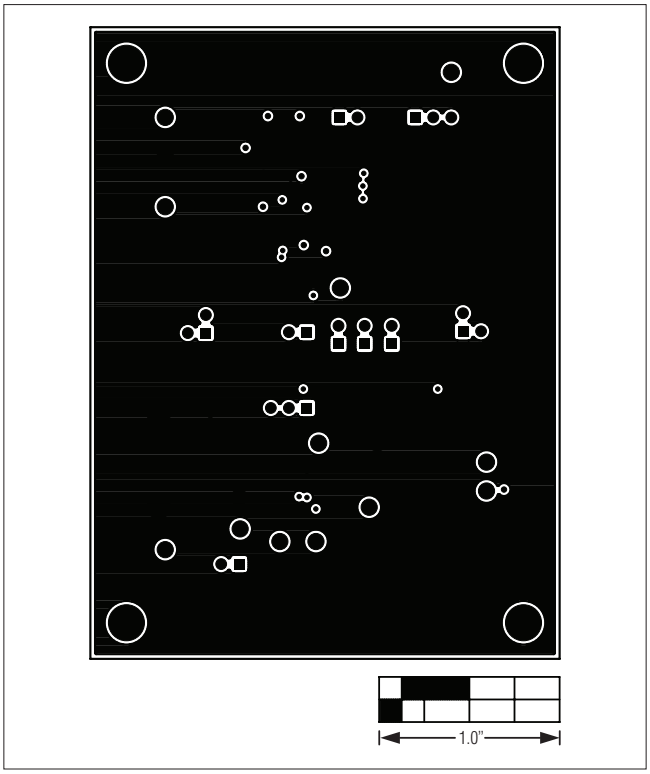

Figure 4. MAX14578A EV Kit PCB Layout—Ground Layer 2

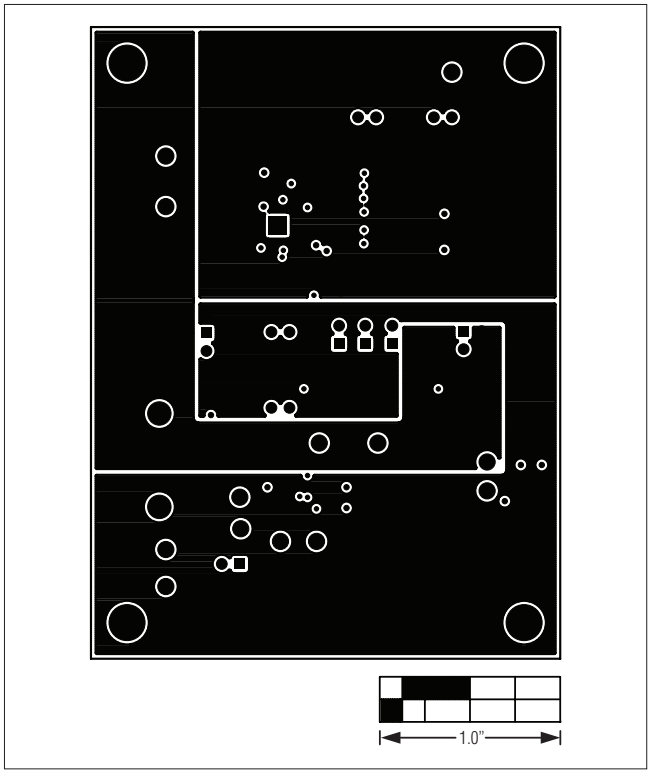

Figure 5. MAX14578A EV Kit PCB Layout—Power Layer 3

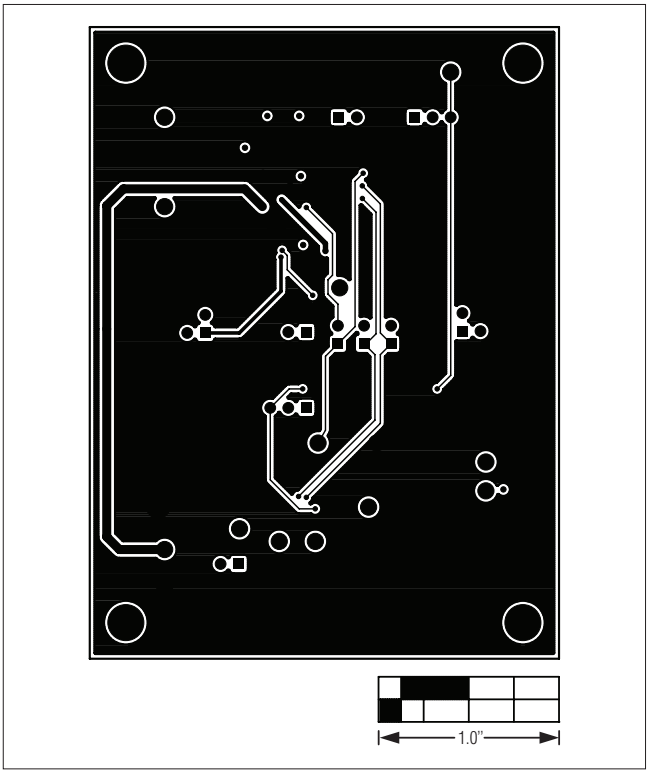

Figure 6. MAX14578A EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX14578AEVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/12	Initial release	—