19-5206; Rev 0; 4/10

MAX17117 Evaluation Kit

Evaluates: MAX17117

General Description

The MAX17117 evaluation kit (EV kit) is a fully assembled and tested surface-mount PCB that provides the voltages and features required for active-matrix, thin-film transistor (TFT), liquid-crystal display (LCD) applications. The EV kit contains a high-performance step-up regulator, a 350mA low-dropout (LDO) linear regulator, a high-speed operational amplifier (op amp), a positive charge pump for the TFT gate-on supply, a negative charge pump for the TFT gate-off supply, and a 7-output high-voltage, level-shifting scan driver with gate-shading control.

The EV kit operates from a DC supply voltage of +2.3V to +5.5V. The step-up switching regulator is configured for a +8.5V output providing at least 250mA from a +2.7V input. The positive charge pump is configured to provide a +23V output providing at least 20mA. The negative charge pump is configured to provide a -6V output providing at least 10mA. The op amp is configured for +4.25V. The high-voltage, level-shifting scan driver with gate-shading control is designed to drive the TFT panel gate drivers.

Features

- **+2.3V to +5.5V Input Range**
- **Output Voltages**
  - **+8.5V Output at 250mA from a +2.7V Input (Step-Up Switching Regulator)**
  - **+23V Output at 20mA (Positive Charge Pump)**
  - **-6V Output at 10mA (Negative Charge Pump)**
  - **+4.25V High-Current Op Amp Capable of Delivering 200mA (typ) Short-Circuit Output Current**
- **Resistor-Adjustable Switching-Regulator, Op-Amp Output, and LDOO Voltages**
- **High-Voltage Level-Shifting Scan Driver with Gate-Shading Control**
- **1.2MHz Step-Up Switching Frequency**
- **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX17117EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10µF ±10%, 10V X5R ceramic capacitor (0805) TDK C2012X5R1A106K Murata GRM21BR61A106K
C2, C3, C4	3	10µF ±10%, 16V X5R ceramic capacitors (1206) Murata GRM31CR61C106K TDK C3216X5R1C106K
C5	1	0.22µF ±10%, 50V X7R ceramic capacitor (0805) Murata GRM21BR71H224K TDK C2012X7R1H224K
C6–C11, C16, C17, C21	9	0.1µF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H104K TDK C1608X7R1H104K
C12, C13	2	1µF ±10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C105K TDK C1608X5R1C105K
C14	1	100pF ±5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H101J
C15, C25, C27, C29, C31, C33, C35, C37	8	4700pF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H472K
C18	1	1µF ±10%, 25V X5R ceramic capacitor (0805) Murata GRM21BR71E105K TDK C2012X5R1E105K
C19	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K TDK C1608X7R1H102K

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C20	1	0.33µF ±10%, 10V X5R ceramic capacitor (0603) Murata GRM188R61A334K TDK C1608X5R1A334K
C22	1	0.22µF ±10%, 25V X5R ceramic capacitor (0603) Murata GRM188R61E224K TDK C1608X5R1E224K
C23	1	2.2µF ±10%, X5R 25V ceramic capacitor (0805) Murata GRM219R61E225K TDK C2012X5R1E225K
C24, C26, C28, C30, C32, C34, C36, C38, C39	0	Not installed, ceramic capacitors (0603)
DTS, LX, POS, RE, RO, SS	6	PCB mini test points
D1	1	1A, 30V Schottky diode (S-Flat) Central Semi CMMSH1-40 LEAD FREE Nihon EP10QY03 Toshiba CRS02(TE85L,Q,M)
D2, D3, D4	3	200mA, 100V dual diodes (SOT23) Fairchild MMBD4148SE (Top Mark: D4) Central Semi CMPD7000+ (Top Mark: C5C)
D5	1	6.2V, 200mW zener diode (SOD323) Fairchild MM3Z6V2B
JU1	1	3-pin header
L1	1	10µH, 1.85A, 74.4mΩ inductor (6mm x 6mm x 3mm) Sumida CDRH5D28RHPNP-100M
P1	0	Not installed, 100-position right-angle header
R1	1	102kΩ ±1% resistor (0603)
R2	1	17.4kΩ ±1% resistor (0603)
R3, R4, R5	3	56.2kΩ ±1% resistors (0603)
R6, R12	2	1kΩ ±5% resistors (0603)
R7, R15, R16, R17	0	Not installed, resistors—short (PC trace) (0603)
R8	1	62kΩ ±5% resistor (0603)
R9	1	51.1kΩ ±1% resistor (0603)
R10	1	49.9kΩ ±1% resistor (0603)
R11	1	29.4kΩ ±1% resistor (0603)
R13	1	49.9Ω ±1% resistor (0603)
R14	1	86.6Ω ±1% resistor (0603)
R18–R24	7	100kΩ ±5% resistors (0603)
R25–R38	14	100Ω ±1% resistors (1210)
R39	0	Not installed, resistor (0603)
SW1	1	7-position, low-profile, surface-mount DIP switch
U1	1	High-voltage PWM IC with level shifters (32 TQFN-EP*) Maxim MAX17117ETJ+
—	1	Shunt
—	1	PCB: MAX17117 EVALUATION KIT+

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor Corp.	631-435-1110	www.centralsemi.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Nihon Inter Electronics Corp.	847-843-7500	www.niec.co.jp
Sumida Corp.	847-545-6700	www.sumida.com
TDK Corp.	847-803-6100	www.component.tdk.com
Toshiba America Electronic Components, Inc.	949-623-2900	www.toshiba.com/taec

Note: *Indicate that you are using the MAX17117 when contacting these component suppliers.*

Quick Start

Recommended Equipment

- 2.3V to 5.5V, 2A DC power supply
- Voltmeters

Procedure

The MAX17117 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

1) Verify that a shunt is installed across pins 1-2 of jumper JU1.
2) Verify that SW1 DIP switches are in the off position.
3) Connect the positive terminal of the power supply to the VIN pad. Connect the negative terminal of the power supply to the PGND pad. Set VIN to +3V.
4) Turn on the power supply and verify that the step-up switching regulator output (VMAIN) is +8.5V.
5) Verify that the gate-on supply (GHON) is approximately +23V.
6) Verify that the gate-off supply (VGL) is approximately -6V.
7) Verify that the output of the high-speed op amp (VOUT) is approximately +4.25V.
8) Verify that the outputs of the high-voltage scan-driver outputs are approximately -6V (= VGL).

Detailed Description of Hardware

The MAX17117 EV kit contains a step-up switching regulator, a positive two-stage charge pump, a negative single-stage charge pump, a high-speed op amp, and a high-voltage, level-shifting scan driver with gate-shading control. The EV kit operates from a DC power supply between +2.3V and +5.5V.

As configured, the step-up switching regulator (VMAIN) generates a +8.5V output and provides at least 250mA from a +2.7V input. The step-up switching-regulator output voltage can be adjusted up to +15V with different feedback resistors (see the *Output-Voltage Selection* section).

The GHON consists of two positive charge-pump stages to generate approximately +23V and provides up to 20mA. The VGL consists of a single negative charge-pump stage configured with a shunt zener diode to generate approximately -6V and provides up to 10mA. Loading GHON and VGL reduces the available VMAIN current proportionally.

The op-amp output (VOUT) is fixed to +4.25V or can be reconfigured to other voltages with changes to the voltage-divider resistors (see the *Output-Voltage Selection* section).

The high-voltage, level-shifting scan driver with gate-shading control is designed to drive the TFT panel gate drivers. Its seven outputs swing 40V (max) between +35V (max) and -15V (min) and swiftly drives capacitive loads. The driver outputs (STH, CKH1–CKH6) swing between their power-supply rails (GHON and VGL) according to the input logic levels on their corresponding inputs (ST, CK1–CK6) except during a gate-shading period. During a gate-shading period, a CKH_ output driver becomes high impedance, and an internal switch connected between the CKH_ output's capacitive load and either RO or RE closes whenever the state of its corresponding CK_ input is logic-low. This allows a portion of an output's GHON-to-VGL transition to be completed by partially discharging its capacitive load through an external resistor attached to either RO or RE, for a duration set by the gate-shading period.

For further details, refer to the *High-Voltage Scan Driver* section in the MAX17117 IC data sheet.

P1 provides an easy interface to connect external circuitry containing the ST and CK1–CK6 logic signals to the EV kit. When driving the ST and CK1–CK6 logic signals through P1, place all SW1 switches in the on position.

Table 1. Jumper JU1 Functions

SHUNT POSITION	ENA PIN	EV KIT OUTPUTS
1-2	ENA connected to LDOO through resistor R8	Outputs enabled (VMAIN = +8.5V)
2-3	ENA connected to ground	Outputs disabled (VMAIN ~ VIN)

**Default position.*

Jumper Selection (JU1)

The EV kit incorporates jumper JU1 to control the chip-enable control. See Table 1 for jumper JU1 functions.

Output-Voltage Selection

Step-Up Switching-Regulator Output Voltage (VMAIN)

The EV kit's step-up switching-regulator output (VMAIN) is set to +8.5V by feedback resistors R1 and R2. To generate output voltages other than +8.5V (up to +15V), select different external voltage-divider resistors R1 and R2. For instructions on selecting the step-up switching regulator feedback divider resistors for other output voltages, refer to the *Output-Voltage Selection* section in the MAX17117 IC data sheet.

Note that changing the VMAIN voltage setting changes the GHON and VGL charge-pump output voltages. The voltage range of VGL is limited to -15V. The voltage range of GHON is limited to +35V. The voltage difference between GHON and VGL should not exceed +40V. If VMAIN is set for more than +11V, disconnect the GHON and VGL pins from the charge-pump outputs. If operation of the high-voltage scan driver is desired for VMAIN greater than +11V, power GHON and VGL from an external supply.

Op-Amp Output Voltage (VOUT)

The EV kit's op amp is configured internally as a unity-gain buffer. The voltage at the noninverting input (POS) is set to half of VMAIN by voltage-divider resistors R4 and R5. To set VOUT to other voltages (up to VMAIN), select different divider resistors according to the following equation:

$$R4 = R5 \times \left(\frac{VMAIN}{VOUT} - 1 \right)$$

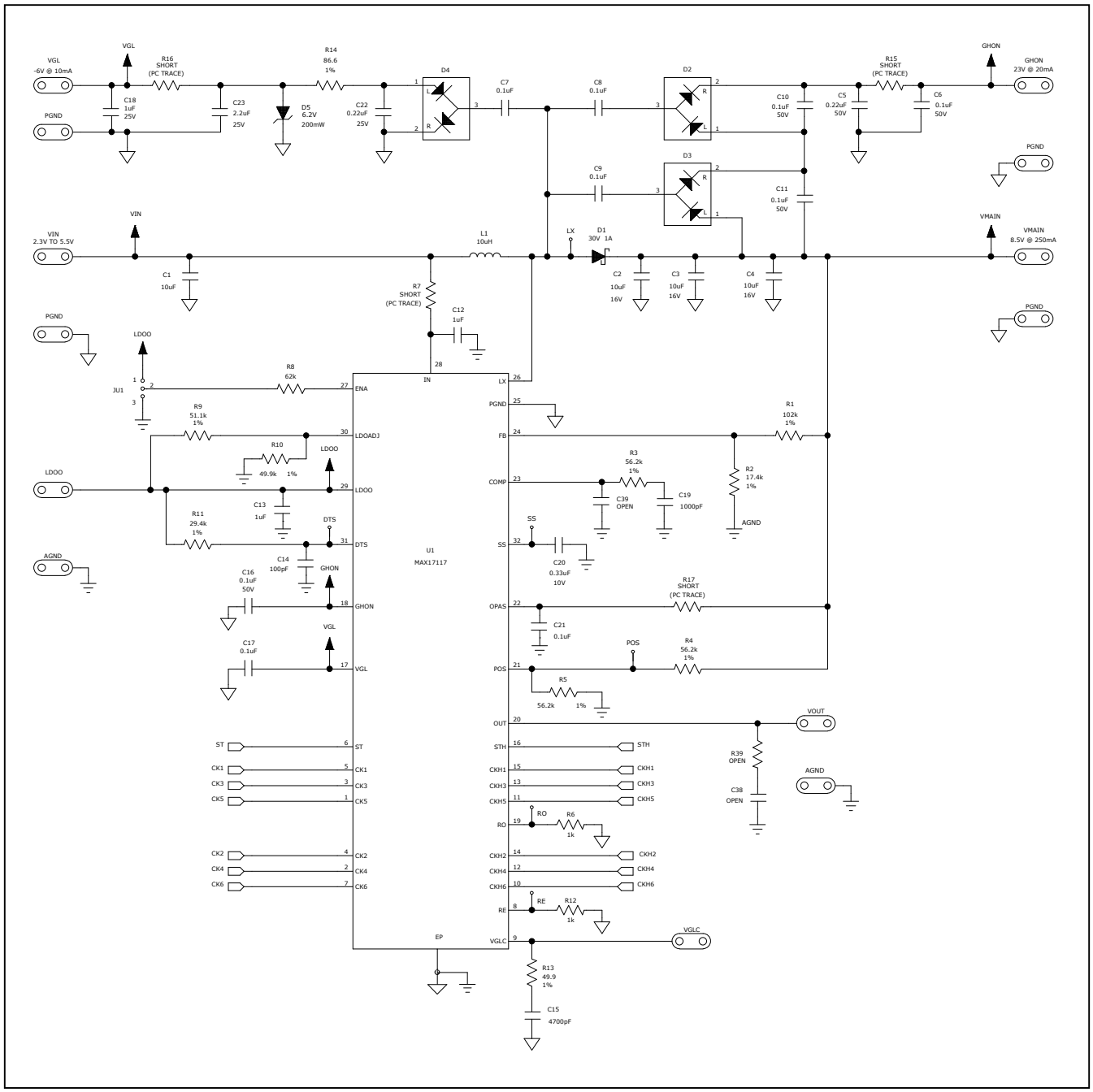

Figure 1a. MAX17117 EV Kit Schematic (Sheet 1 of 3)

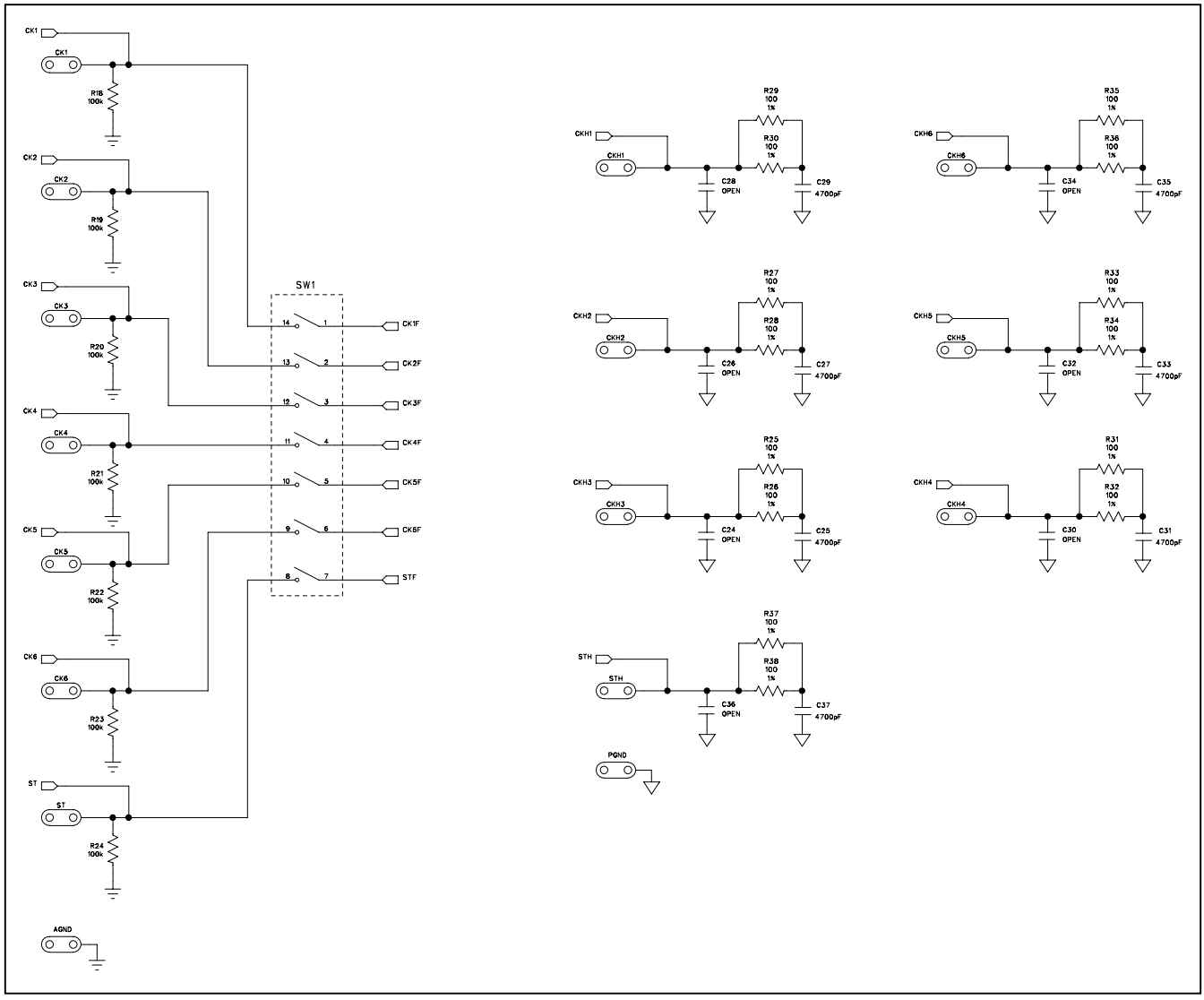

Figure 1b. MAX17117 EV Kit Schematic (Sheet 2 of 3)

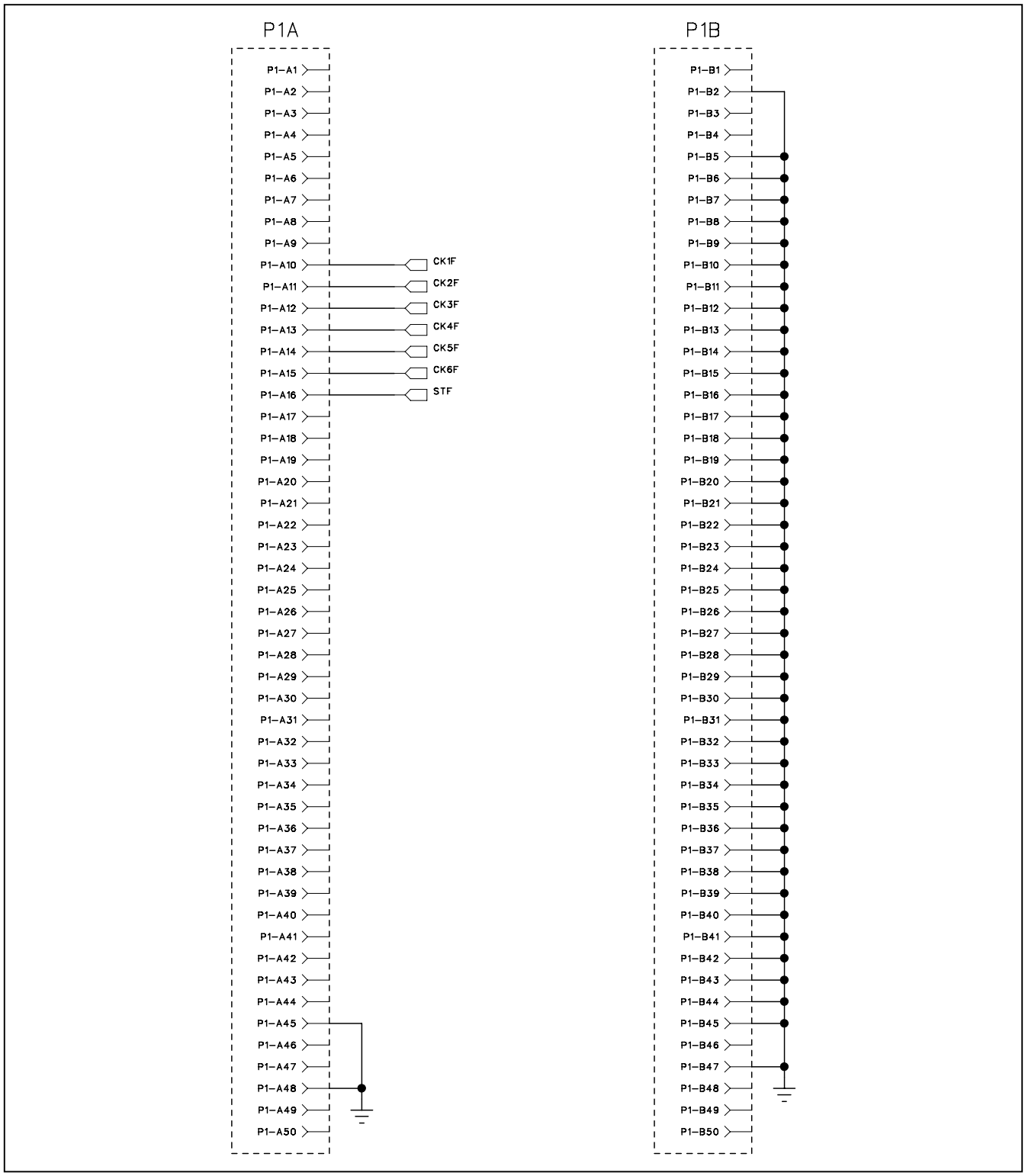

Figure 1c. MAX17117 EV Kit Schematic (Sheet 3 of 3)

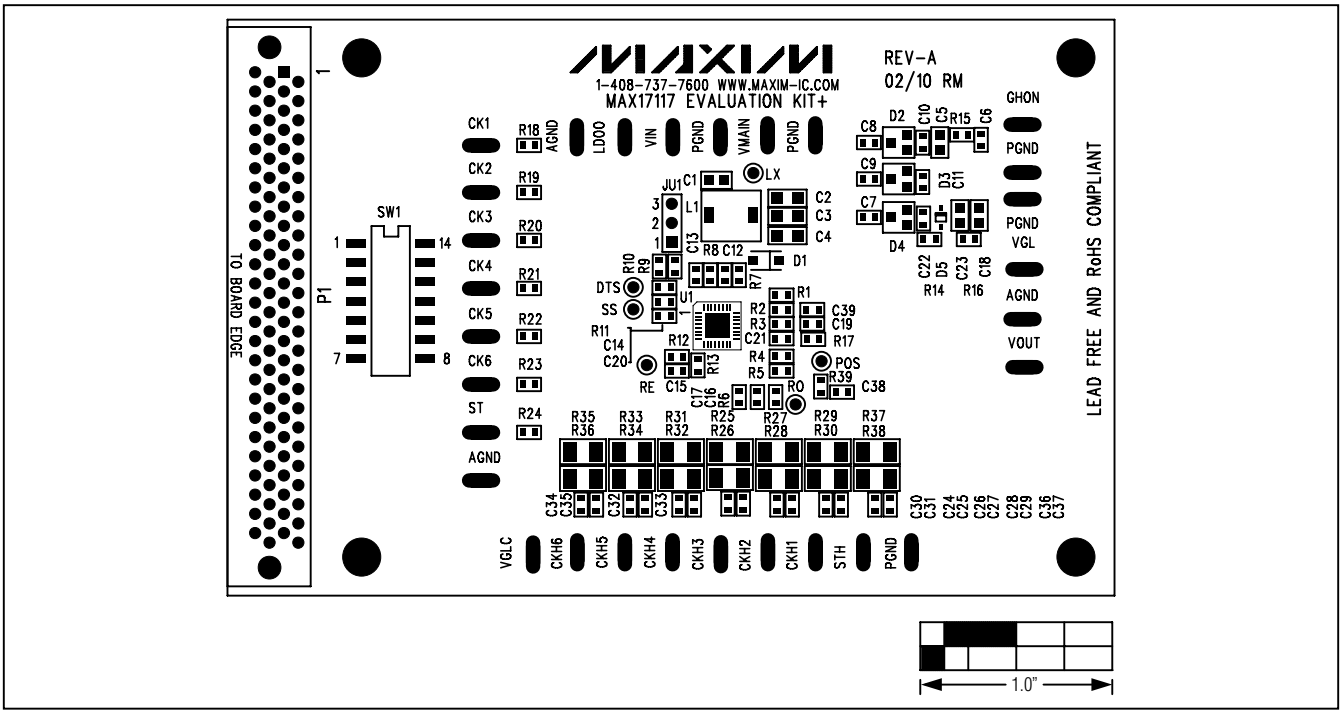

Figure 2. MAX17117 EV Kit Component Placement Guide—Component Side

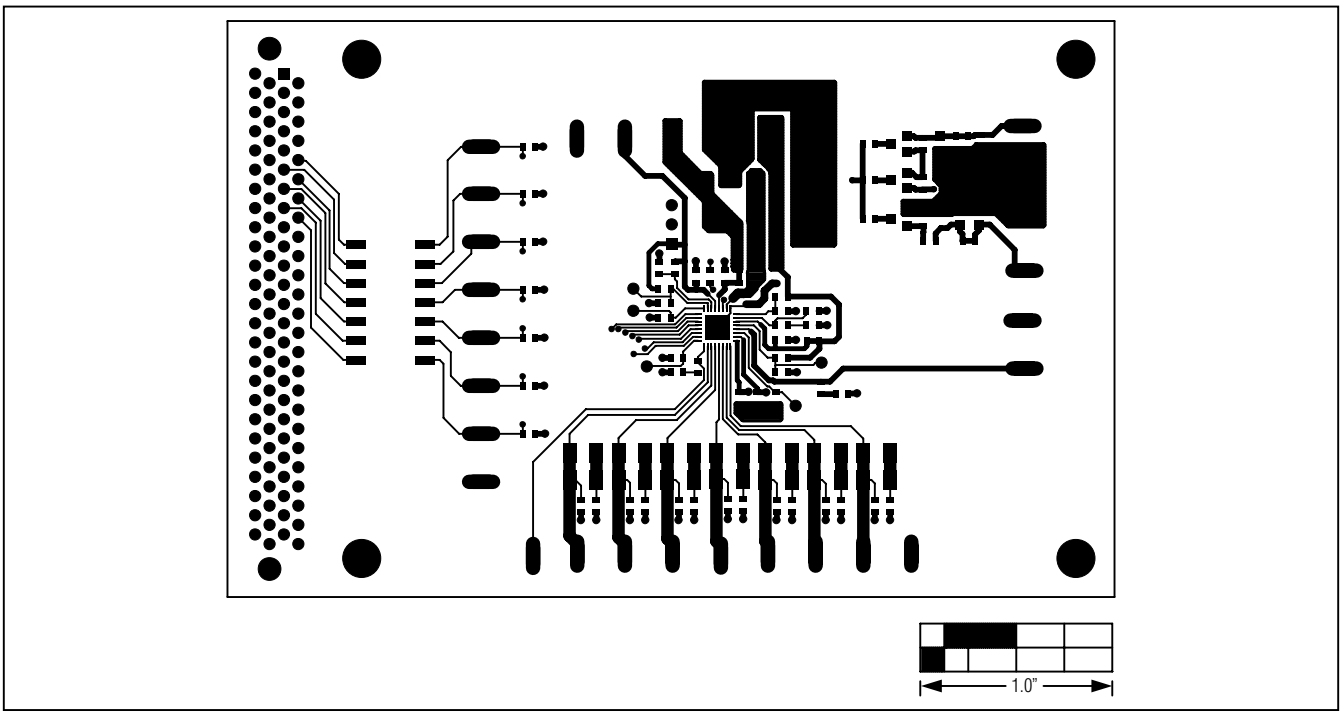

Figure 3. MAX17117 EV Kit PCB Layout—Component Side

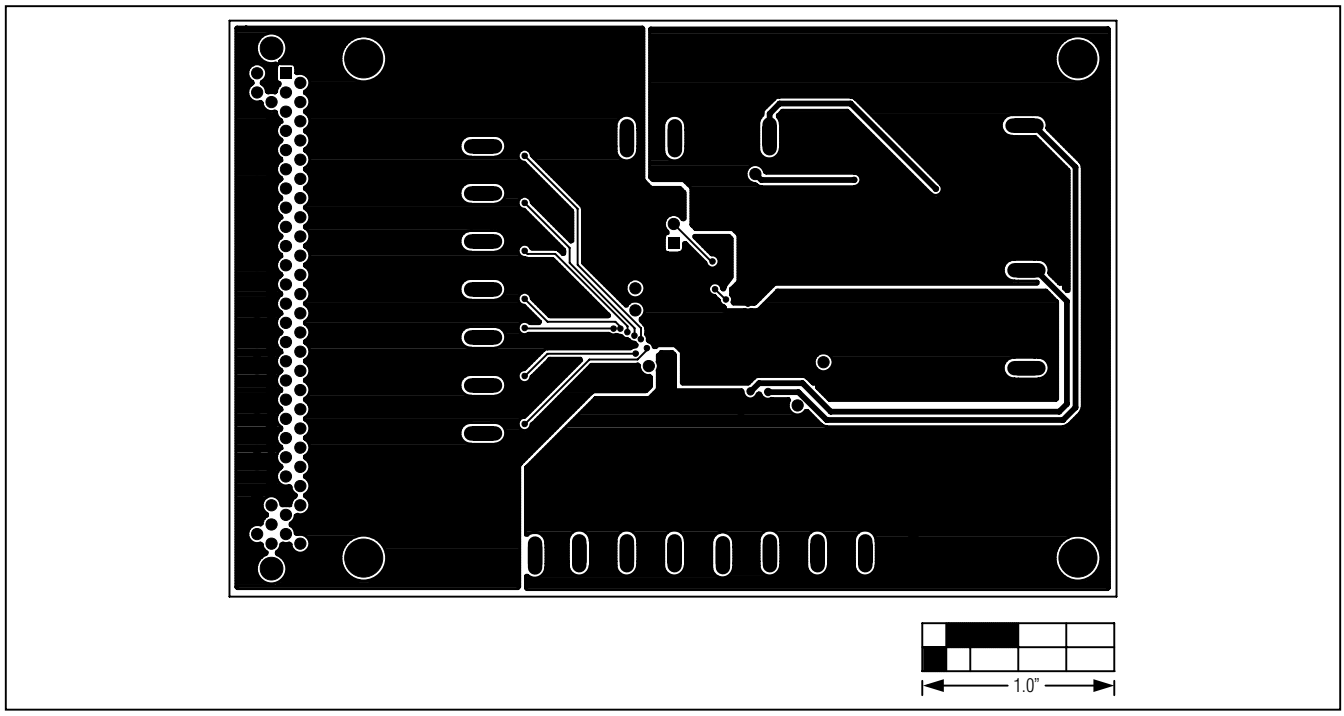

Figure 4. MAX17117 EV Kit PCB Layout—Solder Side

MAX17117 Evaluation Kit

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/10	Initial release	—