19-1987; Rev 0; 3/01

MAXIM

MAX1802 Evaluation Kit for Digital Still Cameras

Evaluates: MAX1802

General Description

The MAX1802 evaluation kit (EV kit) accepts +3.3V to +11V battery voltages and provides all of the output voltages required in digital still cameras (DSC). This EV kit consists of the MAX1802 multi-output master converter and the MAX1801 slave step-up converter.

The MAX1802 EV kit provides 10 separate output voltages. The MAX1802 provides one main system step-down converter (+3.3V/1A), one DSP core step-down (+1.8V/400mA), one step-up converter for the backlight (+7V/100mA), three flyback outputs for the CCD, and three flyback outputs for the LCD. In addition, the MAX1801 provides one general-purpose step-up converter (+12V/100mA).

The MAX1802 EV kit's outputs are adjustable and are suitable for applications running from 4-cell alkaline, NiCd, or NiMH batteries, or from lithium ion (Li+) batteries (1 or 2 cell).

Features

- **10 Outputs**
  - **2 Synchronous Rectified Step-Down Converters**
  - **2 Step-Up Converters**
  - **6 Flyback Outputs**
- **+3.3V to +11V Input Voltage Range**
- **All Converters Synchronized to Single Oscillator**
- **100kHz to 1MHz Switching Frequency (set to 400kHz)**
- **Independent Shutdown of Each Converter**
- **Short-Circuit Protected Flyback Outputs**
- **Soft-Start on Each Output**
- **Fully Assembled and Tested**

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
Central Semiconductor	631-435-1110	631-435-1824
Fairchild Semiconductor	408-721-2181	408-721-1635
Motorola	602-303-5454	602-994-6430
Sumida	847-956-0666	847-956-0702
Taiyo Yuden	408-573-4150	408-573-4159
TDK	847-803-6100	847-803-6296

Note: *Please indicate that you are using the MAX1802 when contacting these component suppliers.*

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX1802EVKIT	0°C to +70°C	32 TQFP

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	100pF ceramic capacitor (0603)
C2, C5, C6, C25	4	0.1µF ceramic capacitors (0603)
C3, C24	2	10µF, 16V ceramic capacitors (1812) TDK C4532X7R1C106M
C4, C7, C8, C9	4	1000pF ceramic capacitors (0603)
C10	1	4.7nF ceramic capacitor (0603)
C11	1	470pF ceramic capacitor (0603)
C12	1	4.7µF, 16V ceramic capacitor (1206) TDK C3216X5R1C475M
C13, C17	2	1µF, 10V ceramic capacitors (0805) TDK C2012X5R1A105M
C14	1	10µF, 10V ceramic capacitor (1206) TDK C3216X5R1A106M
C15	1	100µF, 10V tantalum capacitor (D case) AVX TPSD107M010R0100
C16	1	22µF, 16V ceramic capacitor (1812) TDK C4532X5R1C226M
C18–C23	6	1µF, 25V ceramic capacitors (1206) TDK C3216X7R1E105M
C26	1	10µF, 16V ceramic capacitor (1210) TDK C3225X5R1C106M
D1, D4, D6	3	P-N junction diodes (SOT323) Central Semiconductor CMSD-4448
D2, D3, D5	3	Schottky diodes (SOT323) Central Semiconductor CMSSH-3

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
D7, D8	2	Schottky diodes (SOD123) Motorola MBR0520L or Fairchild Semiconductor MBR0520L
D9	1	Schottky diode (S-FLAT) Toshiba CRS05 (not installed)
JU1–JU6	6	3-pin headers
JU7–JU12	6	2-pin headers
L1	1	4.7µH inductor Sumida CR43-4R7
L2, L4	2	10µH inductors Sumida CDRH6D28-100
L3	1	3.3µH inductor Sumida CR43-3R3
Q1, Q2, Q3, Q5	4	N-channel MOSFETs (SuperSOT-3) Fairchild Semiconductor FDN337N
Q4	1	P-channel MOSFET (SO-8) Vishay/Siliconix SI9803DY
Q6	1	N-channel MOSFET (SuperSOT-3) Fairchild Semiconductor FDN359AN
R1	1	40.2kΩ ±1% resistor (0603)
R2	1	866kΩ ±1% resistor (0603)
R3, R19, R20, R22, R24, R28	6	100kΩ ±1% resistors (0603)
R4, R13, R14, R15	4	10kΩ ±5% resistors (0402)
R5, R6, R26, R27, R30, R31	6	Open (0402), not installed
R7	1	Short (0603), not installed, shorted in the PC board layout
R8–R12	5	Open (0603), not installed
R16	1	33kΩ ±5% resistor (0603)
R17	1	91kΩ ±5% resistor (0603)
R18	1	464kΩ ±1% resistor (0603)
R21	1	44.2kΩ ±1% resistor (0603)
R23	1	165kΩ ±1% resistor (0603)
R25, R29	2	301kΩ ±1% resistors (0603)
R32, R33, R37, R38, R41, R42	6	3kΩ ±5% resistors (1206)
R34, R35, R39, R40	4	200Ω ±5% resistors (1206)
R36	1	750Ω ±5% resistor (1206)
T1	1	Sumida transformer CLQ72-type package Sample number: 6333-T334
T2	1	Sumida transformer CLQ72-type package Sample number: 6333-T333
U1	1	MAX1802EHJ (32-pin TQFP)
U2	1	MAX1801EKA (8-pin SOT23)
None	12	Shunts

Recommended Equipment

- +3.3V to +11V battery or power supply
- Digital voltmeter (DVM)

Quick Start

1) Make sure jumpers JU1–JU6 are connected in the ON position. This ensures all converters will turn on at power-up.
2) Before loading any output, check the output voltage and output current capability shown in Table 1.
3) Make sure jumpers JU7–JU12 are connected if no external loads are attached to the OUT1A, OUT1B, OUT1C, OUT2A, OUT2B, and OUT2C outputs.
4) Attach a +3.3V to +7V battery or power supply to IN.
5) Using the DVM, measure the voltage at MAIN, CORE, OUT1_, OUT2_, OUT3, and OUT4.

Detailed Description

MAIN Output

The main output (MAIN) powers the core supply of the MAX1802. MAIN must be regulated before any of the other outputs function.

To enable MAIN, place jumper JU4 to the ON position. Apply +3.3V to +11V between IN and GND. The voltage between MAIN and GND should be approximately +3.3V. If IN is less than +3.3V, MAIN will not be regulated.

CORE Output

The core output (CORE) is powered from MAIN and regulated at +1.8V using a synchronous-rectified step-down converter. Drawing more than 200mA out of CORE reduces the current capability at MAIN.

To enable CORE, place jumper JU5 to the ON position.

Table 1. Output Voltage and Current Capability

LABEL	VOLTAGE/CURRENT
MAIN	+3.3V at 1A
CORE	+1.8V at 400mA
OUT1A	+13.5V at 10mA
OUT1B	+5V at 50mA
OUT1C	-9V at 10mA
OUT2A	+13.5V at 10mA
OUT2B	+5V at 50mA
OUT2C	-19.0V at 10mA
OUT3	+7V at 100mA
OUT4	+12V at 100mA

OUT1_ (Flyback Outputs)

The voltages at OUT1_ are typical of CCD bias voltages. The output voltages are +13.5V/10mA, +5V/50mA, and -9V/10mA. These voltages are generated through a custom flyback transformer. OUT1B (+5V) is used to regulate the flyback circuit. The other output voltages (+13.5V and -9V) are controlled by the turns-ratio of the flyback transformer. If the +13.5V and -9V outputs are not loaded at the fixed 10mA load, then the output voltage will change from the nominal loaded output voltage. Loads are included on the MAX1802 EV kit by shorting jumpers JU7 through JU12. If external loads are used, remove these jumpers to disable the built-in loads.

To enable OUT1_, place jumper JU6 to the ON position. To disable OUT1_, place jumper JU6 to the OFF position. To enable and disable the output voltages using an external signal, see the *Logic Control of the Output Voltages* section.

If a different set of output voltages is required, see the *Setting the Flyback Circuit Voltages* section.

OUT2_ (Flyback Outputs)

The voltages at OUT2_ are typical of LCD bias voltages. The output voltages are +13.5V/10mA, +5V/50mA, and -19V/10mA. These voltages are generated through a custom flyback transformer. OUT2B (+5V) is used to regulate the flyback circuit. The other output voltages (+13.5V and -19V) are controlled by the turns-ratio of the flyback transformer. If the +13.5V and -19V outputs are not loaded at the fixed 10mA load, then the output voltage will change from the nominal loaded output voltage. Loads are included on the MAX1802 EV kit by shorting jumpers JU7 through JU12. If external loads are used, disable the built-in loads by removing these jumpers.

To enable OUT2_, place jumper JU2 to the ON position. To disable OUT2_, place jumper JU2 to the OFF position. To enable and disable the output voltages using an external signal, see the *Logic Control of the Output Voltages* section.

If a different set of output voltages is required, see the *Setting the Flyback Circuit Voltages* section.

OUT3

The voltage at OUT3 is typical of that required by a CCFL backlight inverter. To enable OUT3, place jumper JU3 to the ON position. Place the external load between OUT3 and GND. To change the output voltage of OUT3, see the *Setting the Step-Up Output Voltage* section. OUT3 is configured for a 7V output. For input voltages greater than 7V, the output will approximately track the input.

OUT3 can be configured to drive a white LED backlight instead of a CCFL backlight.

OUT4

The voltage at OUT4 is a general-purpose +12V output that can supply up to 100mA. To enable OUT4, place jumper JU1 to the ON position. Place the external load between OUT4 and GND. To change the output voltage of OUT4, see *Setting the Step-Up Output Voltage* section.

___Customizing the MAX1802 EV Kit

Setting the Main Output Voltage

MAIN is set by a voltage-divider, which drops the output voltage to the +1.25V feedback threshold voltage. To change the 3.3V setting of MAIN, change the resistor-divider ratio by changing R23. Use:

$$R23 = 80k\Omega/V \times (V_{OUT} - 1.248V)$$

The MAIN output voltage may be set to any voltage between +2.7V and +5.5V. For additional information, refer to the MAX1802 IC data sheet.

Setting the Core Output Voltage

CORE is set by a voltage-divider, which drops the output voltage to the +1.25V feedback threshold voltage. To change the +1.8V setting of CORE, change the resistor-divider ratio by changing R21. Use:

$$R21 = 80k\Omega/V \times (V_{CORE} - 1.248V)$$

CORE may be set to any voltage between +1.25V and +5.5V but must remain less than the voltage at MAIN. The MAX1802 EV kit is configured so that MAIN powers the CORE input.

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Setting the Flyback Circuit Voltages (OUT1_ and OUT2_)

A flyback circuit generates OUT1_ and OUT2_. This allows multiple positive or negative voltages to be generated by a single converter and allows the voltages to drop to 0 when the converter is disabled. The transformer must be designed for a given set of output voltages.

On the flyback circuits, only a single output voltage is directly regulated by the MAX1802. All other voltages are controlled by the transformer's turns-ratio. If another set of output voltages is required, a transformer with a different secondary turns-ratio must be used. Consult the transformer manufacturer for details. Typically, the highest power, positive voltage output of the flyback transformer is fed back to the controller. To change the regulated output voltage, use a different resistor in the voltage-divider. Table 2 lists the resistors used for each output. Leave the resistors off (open) for unregulated outputs.

For a given output voltage, if the bottom resistor is 100kΩ, then the top resistor value is:

$$R\_\_ = 80k\Omega/V \times (V_{OUT} - 1.248V)$$

Setting the Step-Up Output Voltage (OUT3 and OUT4)

The output voltage of the step-up circuit voltages (OUT3 and OUT4) may be set to any voltage above +1.25V. Note that if the battery voltage is greater than the step-up regulation voltage, the output voltage will rise above the regulation voltage. To set the output voltage, choose the voltage-divider resistors. For OUT3, choose:

$$R18 = 80k\Omega/V \times (V_{OUT3} - 1.248V)$$

For OUT4, choose:

$$R2 = 80k\Omega/V \times (V_{OUT3} - 1.248V)$$

Setting the Maximum Duty Cycle

DCON1, DCON2, and DCON3 set the maximum duty cycle for controllers 1, 2, and 3, respectively. A resistor-divider from REF to DCON_ sets the corresponding maximum duty cycle up to 90%. The MAX1802 EV kit has DCON_ shorted to REF, producing a default duty cycle of 76%. Refer to the MAX1802 IC data sheet for additional information.

Setting the Switching Frequency

All of the switching regulators are synchronized to a single oscillator frequency. The oscillator capacitor (C1) is charged through R1 and discharged internally by the MAX1802. The MAX1802 EV kit operates at 400kHz, with MAIN set to 3.3V. Change resistor R1 or capacitor C1 if a different MAIN voltage is used or another frequency is desired. Refer to the MAX1802 IC data sheet for the correct values to use for R1 and C1.

Logic Control of the Output Voltages

Each controller may be independently turned off or on using jumpers (JU1–JU6) or with logic voltages. To control an output using an external logic signal, remove the ON and OFF jumper for that output and place the control signal on the corresponding ON_ pad. To enable MAIN, drive the ON pad greater than +1.8V. To enable CORE or OUT1, drive the corresponding ON_ pad greater than +1.6V. To enable OUT2, OUT3, or OUT4 with the default maximum duty cycle, drive the corresponding ON_ pad to greater than or equal to the reference voltage. If a resistor-divider is used for duty cycle adjustment (R5, R6, R9, R10, R11, and R12), use an open-drain driver on the corresponding ON_ pad. See the *Setting the Maximum Duty Cycle* section for additional information. To disable each output individually, drive the voltage at the corresponding ON_ pad less than +0.3V.

Note that the voltages at OUT3 and OUT4 will drop slightly below the battery voltage when off, due to the DC current path through the inductor and output rectifier. For the step-up outputs, a switch may be added between the output voltage and the load to disconnect them while the output is disabled.

Table 2. Flyback Converter Feedback Resistors

OUTPUT	OUT1_	OUT2_
OUT_A	R30	R26
OUT_B	R29	R25
OUT_C	R31	R27

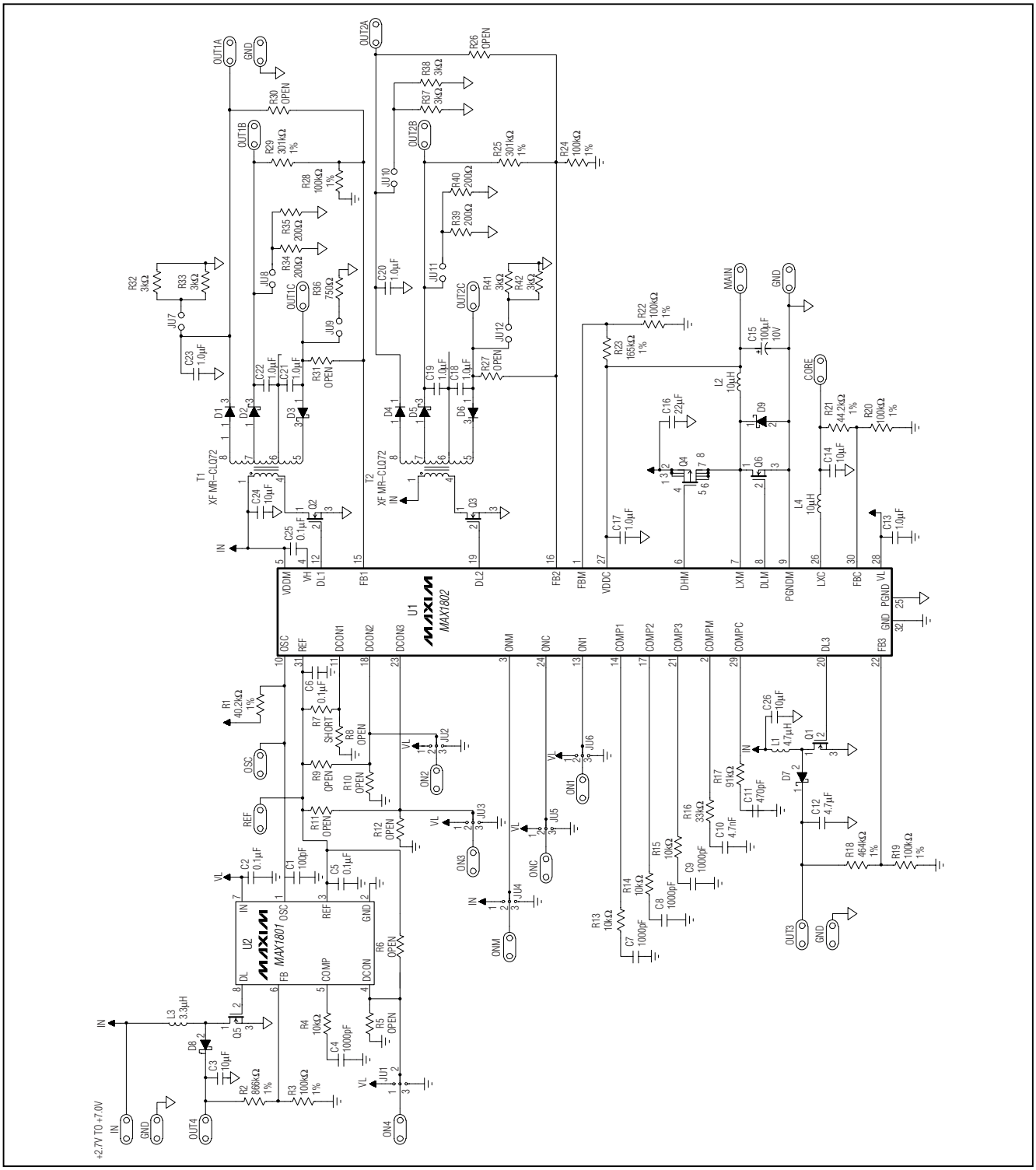

Figure 1. MAX1802 EV Kit Schematic

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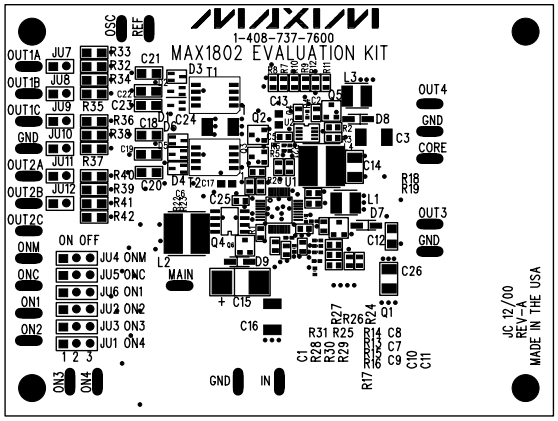
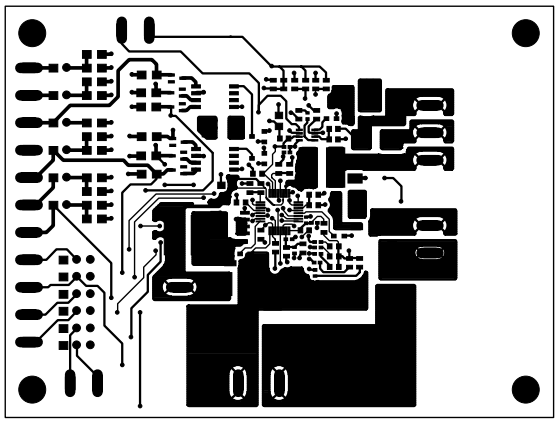


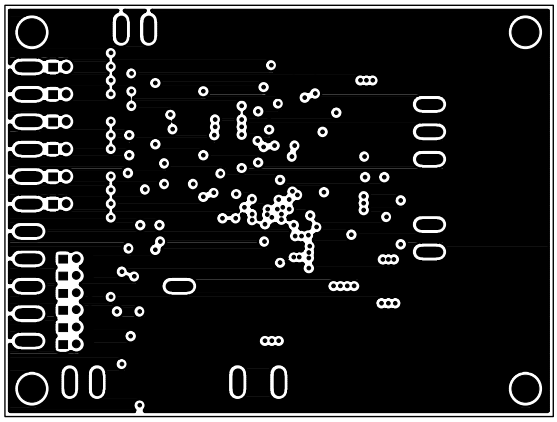
ACTUAL BOARD DIMENSIONS: 3in. X 4in.

Figure 2. MAX1802 EV Kit Component Placement Guide—Top Silkscreen



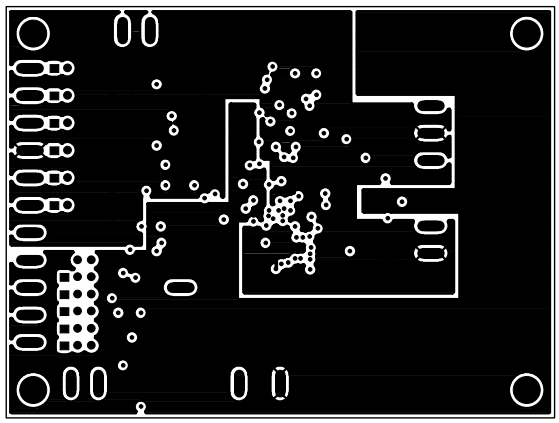
ACTUAL BOARD DIMENSIONS: 3in. X 4in.

Figure 3. MAX1802 EV Kit PC Board Layout—Component Side



ACTUAL BOARD DIMENSIONS: 3in. X 4in.

Figure 4. MAX1802 EV Kit PC Board Layout—GND Layer 2



ACTUAL BOARD DIMENSIONS: 3in. X 4in.

Figure 5. MAX1802 EV Kit PC Board Layout—V_{CC} Layer 3

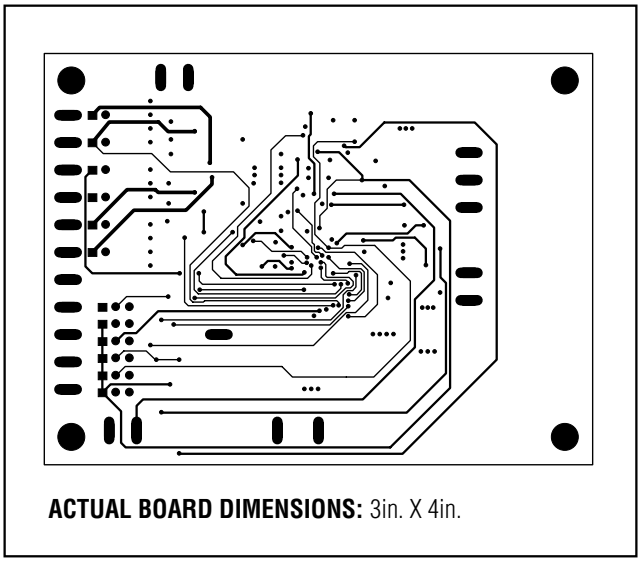


Figure 6. MAX1802 EV Kit PC Board Layout—Solder Side