MAX1637 Evaluation Kit

Evaluates: MAX1637

General Description

The MAX1637 evaluation kit (EV kit) contains two separate switching-regulator circuits. The first circuit converts high-voltage battery power into a low-voltage supply rail for next-generation notebook CPU cores. Its output is fixed at 1.7V and delivers up to 7A output current with greater than 87% efficiency. The second circuit generates a low-voltage supply for general-purpose use. Its output is fixed at 2.5V and delivers up to 3A output current. The battery range for both circuits is 4.5V to 22V, and both require a separate 5V input voltage to power the MAX1637. Output voltages can be adjusted by changing the feedback resistor values.

The MAX1637 EV kit has excellent dynamic response to correct for fast output transients. This EV kit is a fully assembled and tested circuit board.

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX1637EVKIT	0°C to +70°C	16 QSOP

Features

- **4.5V to 22V Battery Voltage Range**
- **4.5V to 5.5V Input Voltage Range (IC Power)**
- **Output Voltage:**
  Fixed 1.7V, 7A (Circuit 1)
  Fixed 2.5V, 3A (Circuit 2)
- **Circuit 1 Efficiency = 90%**
  (V_{IN} = 7V, V_{OUT} = 1.7V @ I_{OUT} = 3A)
- **Circuit 2 Efficiency = 91%**
  (V_{IN} = 7V, V_{OUT} = 2.5V @ I_{OUT} = 3A)
- **3µA Max IC Shutdown Current**
- **Fast MOSFETs for Low Switching Losses**
- **Tight PC Board Layout for Low Switching Losses**
- **300kHz Switching Frequency**
- **Surface-Mount Construction**
- **Fully Assembled and Tested**

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3, C4, C22	5	10µF, 25V ceramic capacitors Tokin C34Y5U1E106Z or United Chemi-Con/Marcon THCR50E1E106ZT
C5, C6, C7, C20 **OR** C5, C6, C7, C8, C20	4	470µF, 6.3V, 30mΩ, low-ESR tantalum capacitors Kemet T510X477M006
	5	470µF, 4V, 55mΩ, low-ESR tantalum capacitors Sprague 594D477X0004R2T
C9, C10, C17, C19	4	0.1µF ceramic capacitors
C11, C16	2	1500pF ceramic capacitors
C12, C15	2	1µF ceramic capacitors
C13, C18	2	4.7µF, 16V tantalum capacitors Sprague 595D475X0016A2B
C14, C21, C23, C24	0	Not installed
C25, C26	2	0.01µF ceramic capacitors
D1	1	2A Schottky diode SGS-Thomson STPS2L25U or Nihon EC20QS03L
D4	1	1A Schottky diode International Rectifier 10BQ040 or Motorola MBRS130LT3

DESIGNATION	QTY	DESCRIPTION
D2, D3	2	Schottky diodes Central Semiconductor CMPSH-3
L1	1	2.2µH power inductor Panasonic P1F2R0HL, Coiltronics UP4B-2R2, or Coilcraft DO5022P-222HC
L2	1	10µH power inductor Sumida CDRH125-100, Coiltronics UP2B-100, or Coilcraft DO3316P-103
N1	1	N-channel MOSFET Fairchild FDS6612 or FDS9412, International Rectifier IRF7803, or Siliconix Si9804DY
N2	1	N-channel MOSFET Fairchild FDS6680 or Siliconix Si4420DY
N3	1	N-channel MOSFET International Rectifier IRF7403 or Siliconix Si4412DY
N4	1	N-channel MOSFET International Rectifier IRF7413, Fairchild NDS8410A, or Siliconix Si4410DY

Component List continued on next page.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R1	1	0.010Ω, 1%, 1W resistor Dale WSL-2512-R010F
R2	1	56.2kΩ, 0.1% resistor Dale TNPW-1206 series
R3	1	100kΩ, 0.1% resistor Dale TNPW-1206 series
R4–R9	6	1MΩ, 5% resistors
R10, R11	2	20Ω, 5% resistors
R12	1	0.020Ω, 1%, 0.5W resistor Dale WSL-2010-R020-F or IRC LR2010-R020-F
R13	1	130kΩ, 1% resistor
R14	1	100kΩ, 1% resistor
U1, U2	2	MAX1637EEE
JU1–JU6	6	2-pin headers
None	1	MAX1637 PC board
None	1	MAX1637 data sheet

Quick Start

The MAX1637 EV kit is fully assembled and tested. Follow these steps to verify board operation. **Do not turn on the power supplies until all connections are completed.**

1.7V Output (7A Configuration)

1) Connect a +4.5V to +22V supply voltage to the VBATT pad. Connect a separate +4.5V to +5.5V supply voltage to the VBIAS pad. Connect the grounds to the GND pads.
2) Connect a voltmeter and load, if any, to the VOUT pad.
3) Turn on the VBATT power supply to the board **first**.
4) Turn on the VBIAS power supply. Verify that the output voltage is 1.7V.
5) For other output voltages, refer to the *Setting the Output Voltage* section in the MAX1637 data sheet for instructions on selecting feedback resistors R2 and R3.

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	(803) 946-0690	(803) 626-3123
Central Semiconductor	(516) 435-1110	(516) 435-1824
Coilcraft	(708) 639-6400	(708) 639-1469
Dale-Vishay	(402) 564-3131	(402) 563-6418
Fairchild	(408) 721-2181	(408)721-1635
International Rectifier	(310) 322-3331	(310) 322-3332
IRC	(512) 992-7900	(512) 992-3377
Kemet	(408) 986-0424	(408) 986-1442
Motorola	(602) 303-5454	(602) 994-6430
Panasonic	(714) 373-7939	(714) 373-7183
Sanyo	(619) 661-6835	(619) 661-1055
SGS-Thomson	(617) 259-0300	(617) 259-9442
Siliconix	(408) 988-8000	(408) 970-3950
Sprague	(603) 224-1961	(603) 224-1430
Sumida	(847) 956-0666	(847) 956-0702
Taiyo Yuden	(408) 573-4150	(408) 573-4159
Tokin	(408) 432-8020	(408) 434-0375
Vishay/Vitramon	(203) 268-6261	(203) 452-5670

Note: *Please indicate that you are using the MAX1637 when contacting these component suppliers.*

2.5V Output (3A Configuration)

1) Connect a +7V to +22V supply voltage to the VBATT pad. Connect a +4.5V to +5.5V supply voltage to the VBIAS pad. Connect the grounds to the GND pads.
2) Connect a voltmeter and load, if any, to the VOUT pad.
3) Turn on the VBATT power supply to the board **first**.
4) Turn on the VBIAS power supply. Verify that the output voltage is 2.5V.
5) For other output voltages, refer to the *Setting the Output Voltage* section in the MAX1637 data sheet for instructions on selecting feedback resistors R13 and R14.

Table 1. Jumpers JU1 and JU2 Functions

SHUNT LOCATION	$\overline{SKIP}$ PIN	OPERATIONAL MODE
OFF	Connected to GND	Idle mode, pulse-skipping operation for highest light-load efficiency
ON	Connected to V_{BIAS}	Low-noise mode, fixed frequency PWM operation.

Table 2. Jumpers JU3 and JU4 Functions

SHUNT LOCATION	$\overline{SYNC}$ PIN	FREQUENCY (kHz)
OFF	Connected to V_{BIAS}	300
ON	Connected to GND	200

Detailed Description

Both switching regulators require a bias supply voltage (VBIAS) to power the IC and provide gate-drive current. VBIAS must be in the range of 4.5V to 5.5V due to the MOSFETs selected, although the MAX1637 itself operates over a wider range (3.15V to 5.5V). The +5V VBIAS supply must be capable of sourcing at least 20mA. Actual VBIAS current draw is:

$$I_{BIAS} = (Q_{G1} + Q_{G2}) \times f + I_{CC}$$

where Q_{G1}, Q_{G2} is the total gate charge of the MOSFETs at V_{GS} = VBIAS, and I_{CC} is the current drawn by the MAX1637 V_{CC} input.

Battery power must be applied prior to VBIAS power due to the output undervoltage lockout built into the MAX1637. If VBIAS is applied first, the circuit begins switching and attempts to bring up the output voltage. Since battery power is not present, the 20ms UVLO timer expires and the PWM is latched off until VBIAS or $\overline{SHDN}$ is cycled.

Table 3. Jumpers JU5 and JU6 Functions

SHUNT LOCATION	$\overline{SHDN}$ PIN	MAX1637 OUTPUT
OFF	Connected to V_{BIAS}	MAX1637 enabled
ON	Connected to GND	Shutdown mode, V_{OUT} = 0V

Jumper Selection

The 2-pin headers JU1 and JU2 select the mode of operation. Table 1 lists the selectable jumper options. The 2-pin headers JU3 and JU4 select the operating frequency. Table 2 lists the selectable jumper options. The EV kit's components are selected for 300kHz operation. Component values might need to be changed if 200kHz operation is selected (refer to the *Design Procedure* section in the MAX1637 data sheet). Synchronize the oscillator to an external clock signal by driving the SYNC pad with a pulse train of 5V amplitude in the 240kHz to 340kHz frequency range. The 2-pin headers JU5 and JU6 select the shutdown mode. Table 3 lists the selectable jumper options.

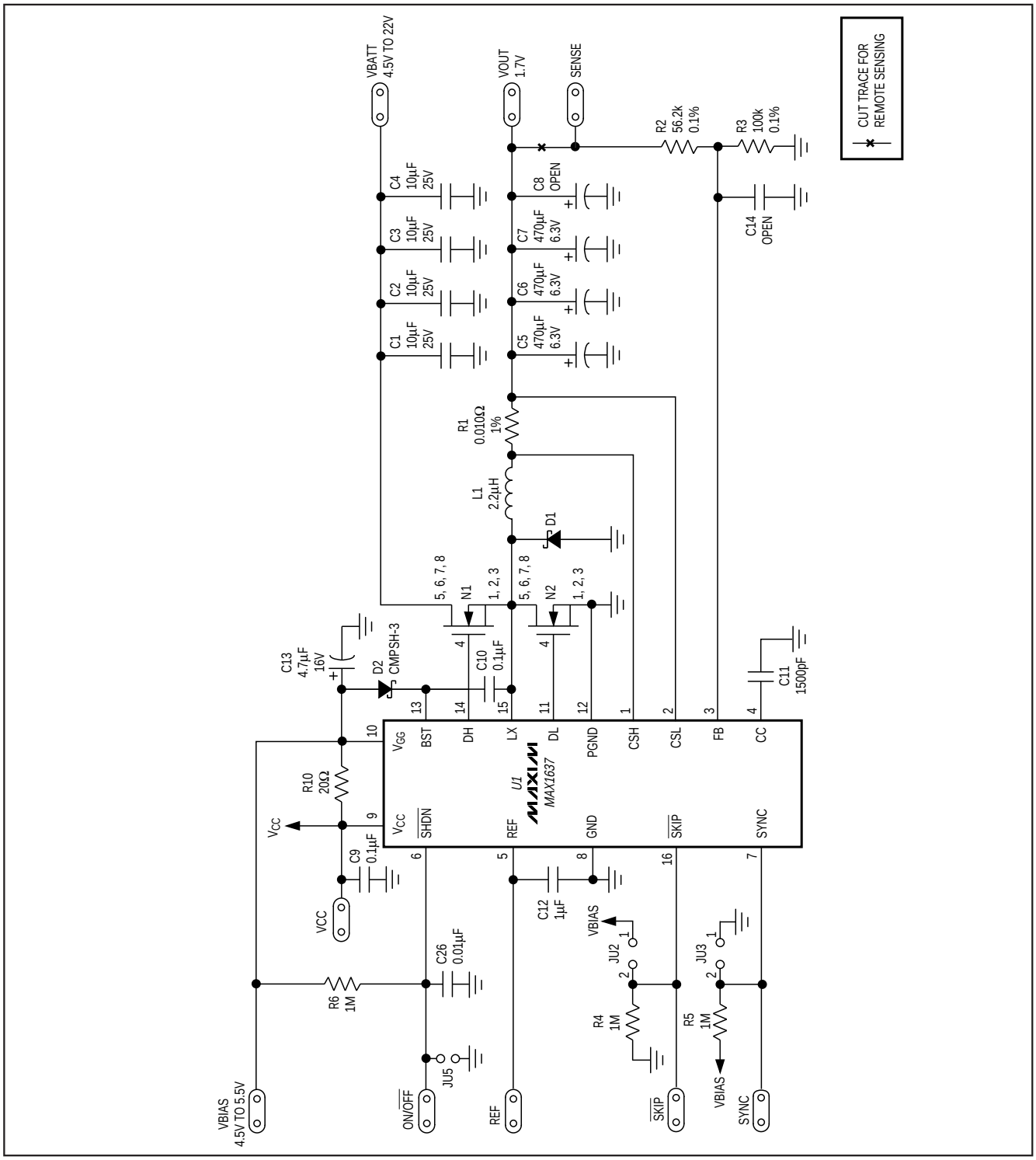

Figure 1. MAX1637 EV Kit Schematic (1.7V, 7A)

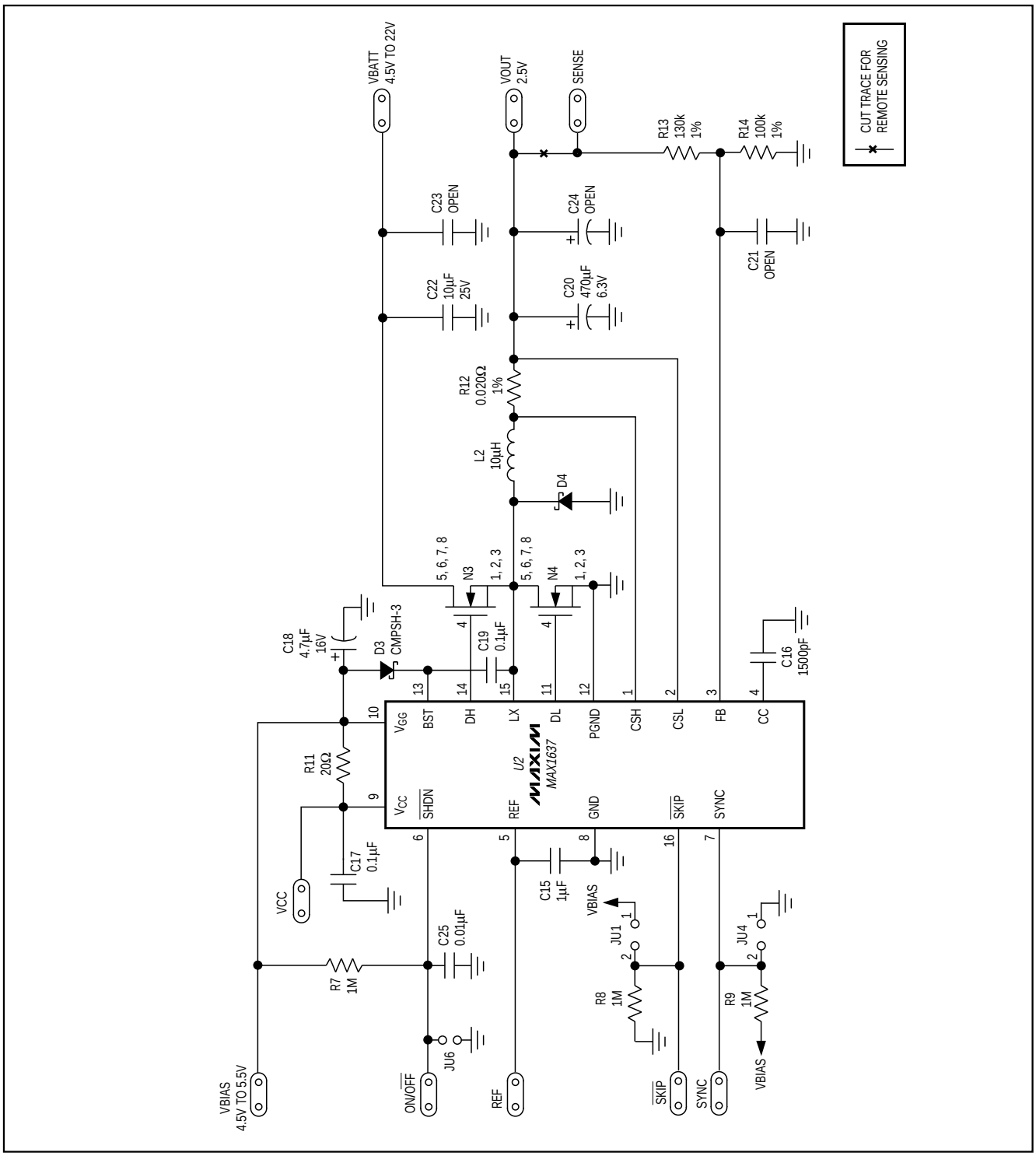

Figure 2. MAX1637 EV Kit Schematic (2.5V, 3A)

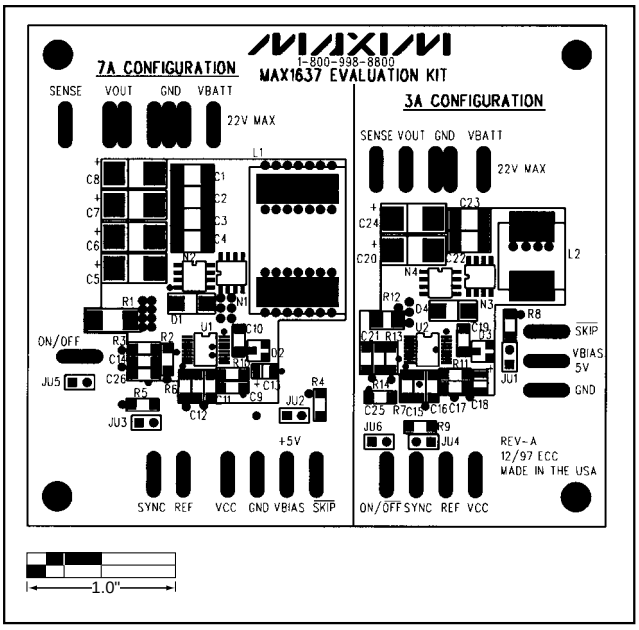

Figure 3. MAX1637EV Kit—Component Placement Guide

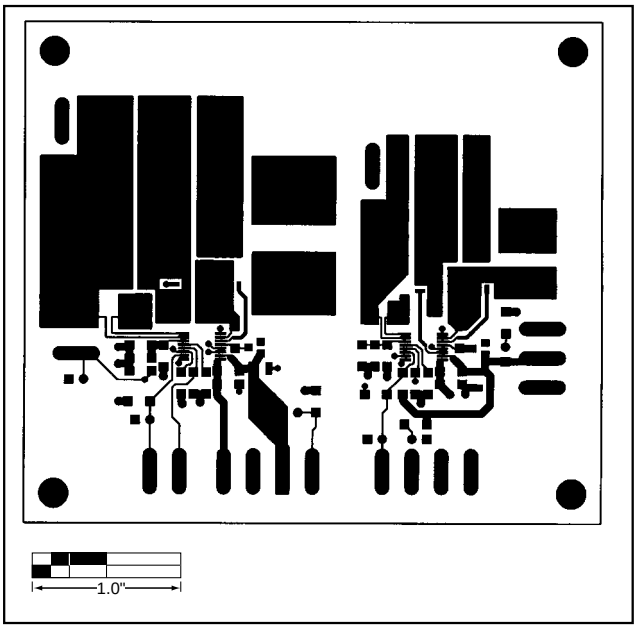

Figure 4. MAX1637 EV Kit PC Board Layout—Component Side

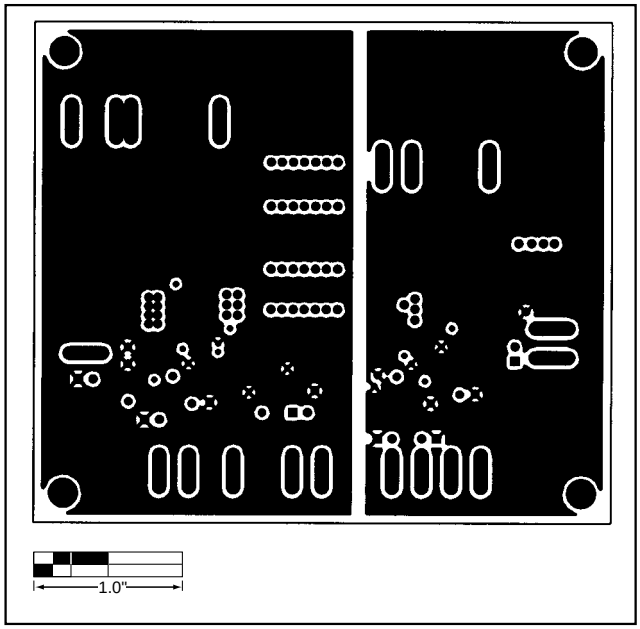

Figure 5. MAX1637 EV Kit PC Board Layout—Two Internal Ground Planes

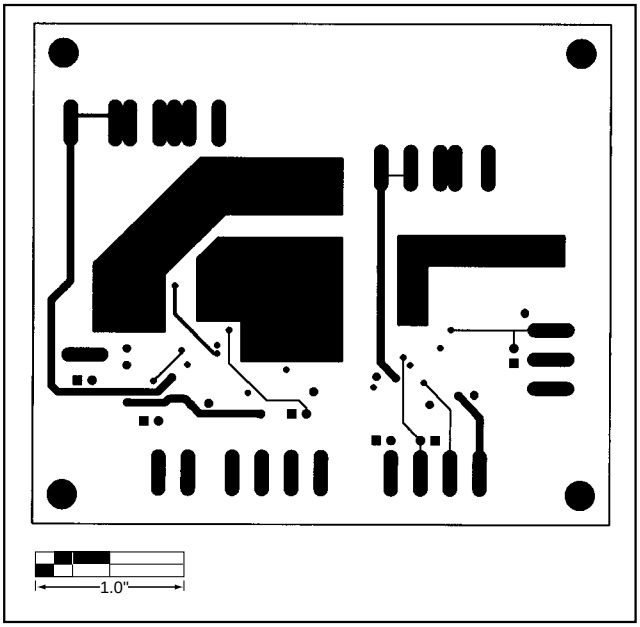

Figure 6. MAX1637 EV Kit PC Board Layout—Solder Side

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