



MAX1533 Evaluation Kit

General Description

The MAX1533 evaluation kit (EV kit) demonstrates the MAX1533's standard application circuit. This dual-PWM synchronous DC-DC converter steps down high-voltage batteries and/or AC adapters, generating main supplies for notebook computers. The MAX1533 EV kit operates at 300kHz switching frequency and provides dual 5V and 3.3V output voltages from a 5V to 24V battery input range. It delivers up to 5A output current for the 5V output and 6A for the 3.3V output with 97% efficiency. Both outputs are adjustable between 1V and 5.5V by changing feedback resistors R19–R22.

The MAX1533 also has an internal fixed 3.3V and 5V linear regulator capable of supplying 100mA. The MAX1533 EV kit operates at 300kHz switching frequency.

Features

- ◆ 6V to 24V Input Range
- ◆ Internal 5V and 3.3V Linear Regulators with 100mA Load Capability
- ◆ Output Voltage:
 - 3.3V at 5A (Adjustable from 1V to 5.5V)
 - 5V at 5A (Adjustable from 1V to 5.5V)
- ◆ 300kHz Switching Frequency (Selectable 200kHz/300kHz/500kHz)
- ◆ Power-Good Output
- ◆ Selectable Over- and Undervoltage Protection
- ◆ 32-Pin Thin QFN Package
- ◆ Fully Assembled and Tested

Ordering Information

| PART | TEMP RANGE | IC PACKAGE |
|--------------|--------------|-------------|
| MAX1533EVKIT | 0°C to +70°C | 32 Thin QFN |

Component List

| DESIGNATION | QTY | DESCRIPTION |
|---------------|-----|---|
| C1 | 0 | Not installed, capacitor (1812) |
| C2, C3 | 2 | 10 μ F \pm 10%, 25V X7R ceramic capacitors (1812) TDK C4532X7R1E106K |
| C4, C6 | 0 | Not installed, D-size capacitors |
| C5 | 1 | 150 μ F \pm 20%, 6.3V, 25m Ω POSCAP/KO-CAP Kemet T520D157M006ASE025 Sanyo 6TPE150M |
| C7 | 1 | 220 μ F \pm 20%, 6.3V, 25m Ω POSCAP/KO-CAP Kemet T520V227M006ASE025 Sanyo 6TPE220M |
| C9, C11, C18 | 3 | 1 μ F \pm 10%, 10V, X5R ceramic capacitors (0603) Murata GRM188R61A105K TDK C1608X5R1A105K |
| C10, C14, C17 | 3 | 0.1 μ F \pm 10%, 25V X7R ceramic capacitors (0603) Murata GRM188R71E104K TDK C1608X7R1E104K |
| C12 | 1 | 0.22 μ F \pm 10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71E224K TDK C1608X7R1C224K |

| DESIGNATION | QTY | DESCRIPTION |
|-----------------------|-----|--|
| C13 | 1 | 0.022 μ F \pm 10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H223K TDK C1608X7R1H223K |
| C15, C19 | 2 | 10 μ F \pm 20%, 6.3V X5R ceramic capacitors (0805) Murata GRM21BR60J106M TDK C2012X5R0J106M |
| C16 | 0 | Not installed, capacitor (0805) |
| C23 | 1 | 4.7 μ F \pm 10%, 25V X7R ceramic capacitor (1210) TDK C3225X7R1E475K |
| C24, C25 | 0 | Not installed, capacitors (0603) |
| D1, D2 | 2 | 2A, 30V, SMA Schottky diodes Central Semiconductor CMSH2-40M Diodes Inc. B230A |
| D3 | 1 | 100mA, 30V, dual Schottky diode, common anode, SOT23 Central Semiconductor CMPSH-3A |
| JU1–JU6 | 6 | 3-pin headers, 0.1in center |
| JU8 | 1 | 6-pin header, 2x3, 0.1in center |
| JU9, JU10, JU12, JU14 | 0 | Not installed, 2-pin jumpers (0603) |



For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

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Component List (continued)

| DESIGNATION | QTY | DESCRIPTION |
|-------------------------|-----|--|
| L1, L2 | 2 | 5.8 μ H, 8.6A, 16.2m Ω inductors Sumida CDRH127/LD-5R8NC |
| N1, N3 | 2 | 8.4A, 30V n-channel MOSFETs, SO-8 Fairchild FDS6612A |
| N2, N4 | 2 | 13A, 30V n-channel MOSFETs, SO-8 Fairchild FDS6670A |
| R1, R2 | 2 | 0.01 Ω \pm 1%, 0.5W sense resistor (2010) IRC LRC-LRF2010-01-R010-F Vishay Dale WSL2010 0.010 1.0% |
| R3 | 1 | 20 Ω \pm 5% resistor (0603) |
| R4–R12, R16, R19–R24 | 0 | Not installed, resistors (0603) |
| R14 | 1 | 100k Ω \pm 5% resistor (0603) |
| R15 | 0 | Not installed, resistor (1206) |
| U1 | 1 | MAX1533ETJ, 32-pin thin QFN (5mm x 5mm) |
| None | 1 | MAX1533 EV Kit PC board |
| None | 7 | Shunts |

Quick Start

Recommended Equipment

Before beginning, the following equipment is recommended:

- 6V to 24V, 100W, DC power supply
- Dummy loads capable of sinking 5A
- 3 voltmeters
- An oscilloscope

Procedure

The MAX1533 EV kit is a fully assembled and tested surface-mount board. Follow the steps below to verify board operation. **Do not turn on the power supply until all connections are completed.**

- 1) Verify that the shunts are in the following positions:
 - JU1 = 1-2 (overvoltage protection disabled)
 - JU2 = 1-2 (MAX1533 enabled)
 - JU3 = 1-2 (undervoltage protection disabled)
 - JU4 = 1-2 (PWM mode)
 - JU5 = 1-2 (5V main output enabled)
 - JU6 = 1-2 (3.3V main output enabled)
 - JU8 = 3-4 (300kHz operation)
- 2) Connect the power supply across the VIN and PGND pads.
- 3) Connect a voltmeter across the 5V_MAIN and PGND pads.
- 4) Connect a voltmeter across the 3.3V_MAIN and PGND pads.
- 5) Turn on the power supply.
- 6) Verify the output voltages.

Component Suppliers

| SUPPLIER | PHONE | FAX | WEBSITE |
|---------------------------------------|--------------|--------------|-----------------------|
| Central Semiconductor | 631-435-1110 | 631-435-1824 | www.centalsemi.com |
| Diodes Incorporated | 805-446-4800 | 805-446-4850 | www.diodes.com |
| Fairchild Semiconductor | 888-522-5372 | — | www.fairchildsemi.com |
| IRC (International Resistive Company) | 361-992-7900 | 361-992-3377 | www.irctt.com |
| Kemet | 864-963-6300 | 864-963-6322 | www.kermit.com |
| Murata | 770-436-1300 | 770-436-3030 | www.murata.com |
| Sanyo | 619-661-6835 | 619-661-1055 | www.sanyodevice.com |
| Sumida | 847-545-6700 | 847-545-6720 | www.sumida.com |
| TDK | 847-803-6100 | 847-390-4405 | www.component.tdk.com |
| Vishay | 402-564-3131 | 402-563-6296 | www.vishay.com |

Note: Indicate that you are using the MAX1533 when contacting these suppliers.

MAX1533 Evaluation Kit

Evaluates: MAX1533

Table 1. Jumper Selection

| FUNCTION | JUMPER | JUMPER POSITION | DESCRIPTION |
|--------------------------|--------|-----------------|--|
| $\overline{\text{OVP}}$ | JU1 | 1-2* | Disables overvoltage protection |
| | | 2-3 | Enables overvoltage protection |
| $\overline{\text{SHDN}}$ | JU2 | 1-2* | Enables the MAX1533 |
| | | 2-3 | Places the MAX1533 in shutdown |
| $\overline{\text{UVP}}$ | JU3 | 1-2* | Disables undervoltage protection |
| | | 2-3 | Enables undervoltage protection |
| $\overline{\text{SKIP}}$ | JU4 | 1-2* | Places the MAX1533 in low-noise forced-PWM mode |
| | | 2-3 | Places the MAX1533 in high-efficiency pulse-skipping mode at light loads |
| ON5 | JU5 | 1-2* | Enables the 5V main output |
| | | 2-3 | Disables the 5V main output |
| ON3 | JU6 | 1-2* | Enables the 3.3V main output |
| | | 2-3 | Disables the 3.3V main output |

*Default position.

Detailed Description

3.3V_MAIN Output Voltage Setting

The MAX1533 EV kit is shipped with FB3 connected to GND, which sets the 3.3V_MAIN voltage to 3.3V.

To change the output voltage to a value between 1V and 5.5V, set R20 equal to $10\text{k}\Omega \pm 1\%$ and calculate R19 using the equation:

$$R19 = R20 [(V_{\text{OUT}}/V_{\text{FB3}}) - 1]$$

where $V_{\text{FB3}} = 1\text{V}$. For an output voltage of 1V, place a short across R19 and leave R20 open.

5V_MAIN Output Voltage Setting

The MAX1533 EV kit is shipped with the FB5 connected to GND, which sets the 5V_MAIN voltage to 5V.

To change the output voltage to a value between 1V and 5.5V, set R22 equal to $10\text{k}\Omega \pm 1\%$ and calculate R21 using the equation:

$$R21 = R22 [(V_{\text{OUT}} / V_{\text{FB5}}) - 1]$$

where $V_{\text{FB5}} = 1\text{V}$. For an output voltage of 1V, place a short across R21 and leave R22 open.

Frequency Selection

The MAX1533 operates at 200kHz/300kHz/500kHz switching frequency. The EV kit is shipped with the frequency set to 300kHz. Move the shunt on JU8 to select a different switching frequency (see Table 2).

Table 2. Frequency Selection

| FREQUENCY (kHz) | FSEL (JU8) |
|-----------------|-----------------------|
| 200 | GND (1-2) |
| 300* | REF (3-4) |
| 500 | V _{CC} (5-6) |

*Default position.

Note: Do not change the operating frequency without first recalculating component values because the frequency has a significant effect on preferred inductor value, peak current-limit level, MOSFET heating, PFM/PWM switchover point, output noise, efficiency, and other critical parameters.

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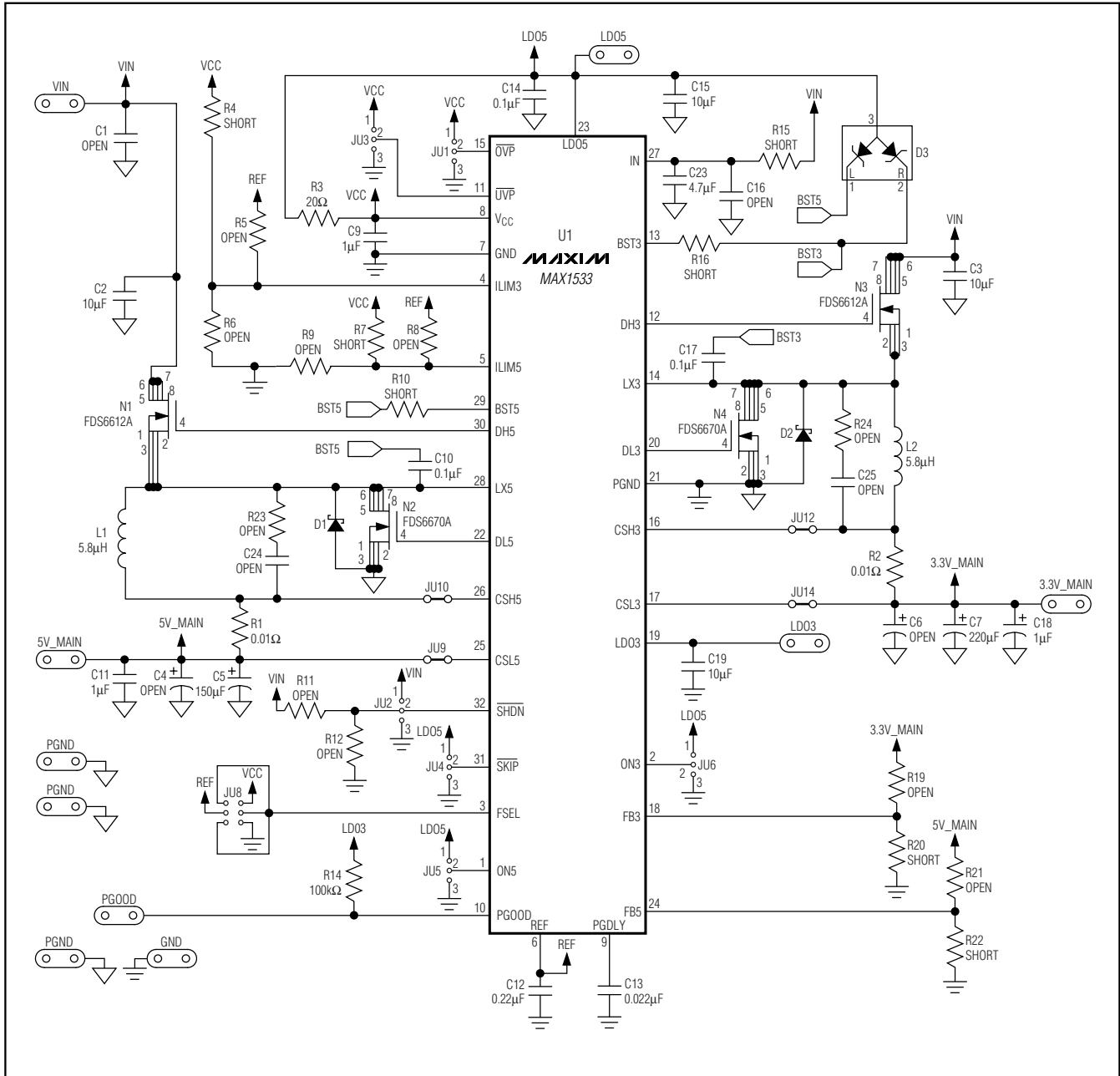


Figure 1. MAX1533 EV Kit Schematic

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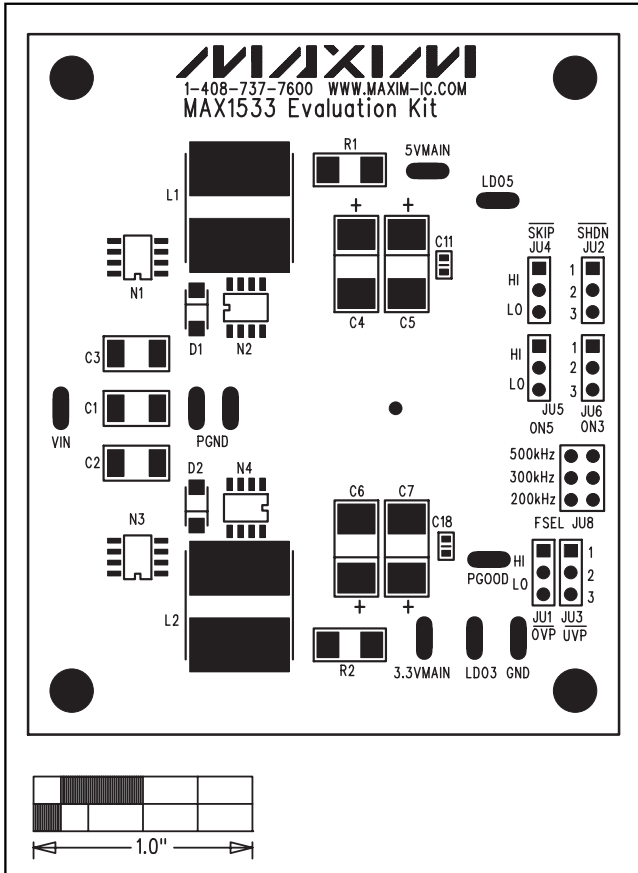


Figure 2. MAX1533 EV Kit Component Placement Guide—Component Side

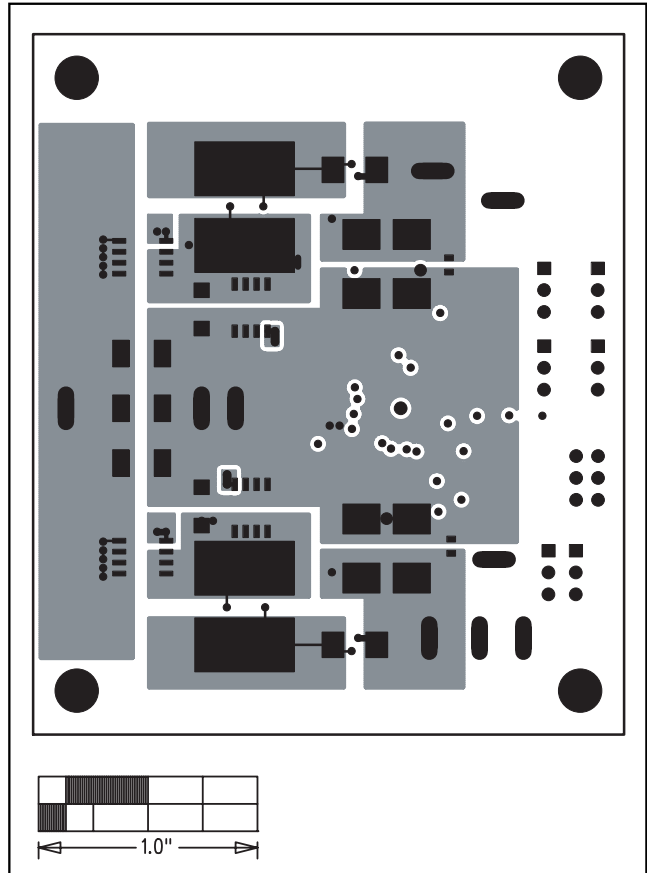


Figure 3. MAX1533 EV Kit PC Board Layout—Component Side

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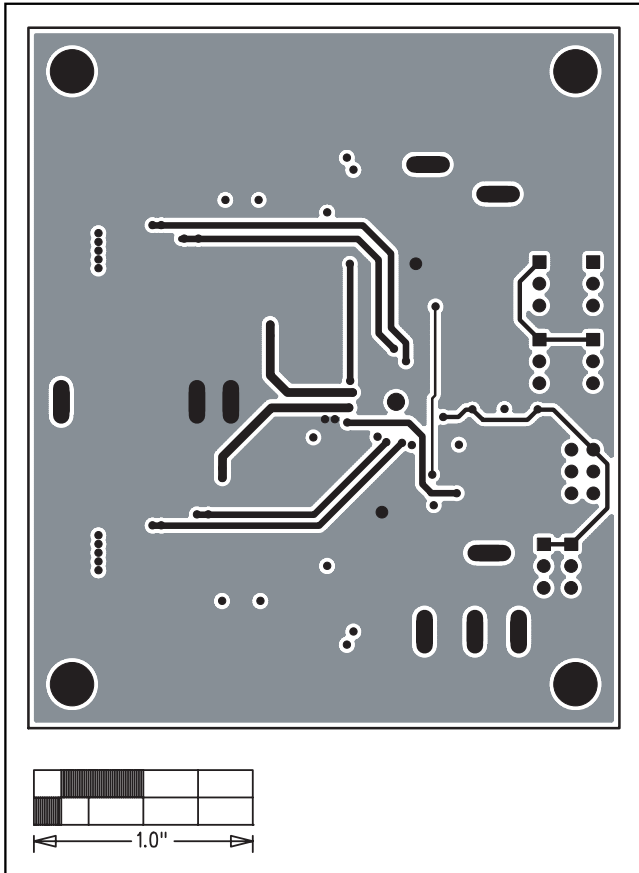


Figure 4. MAX1533 EV Kit PC Board Layout—Layer 2

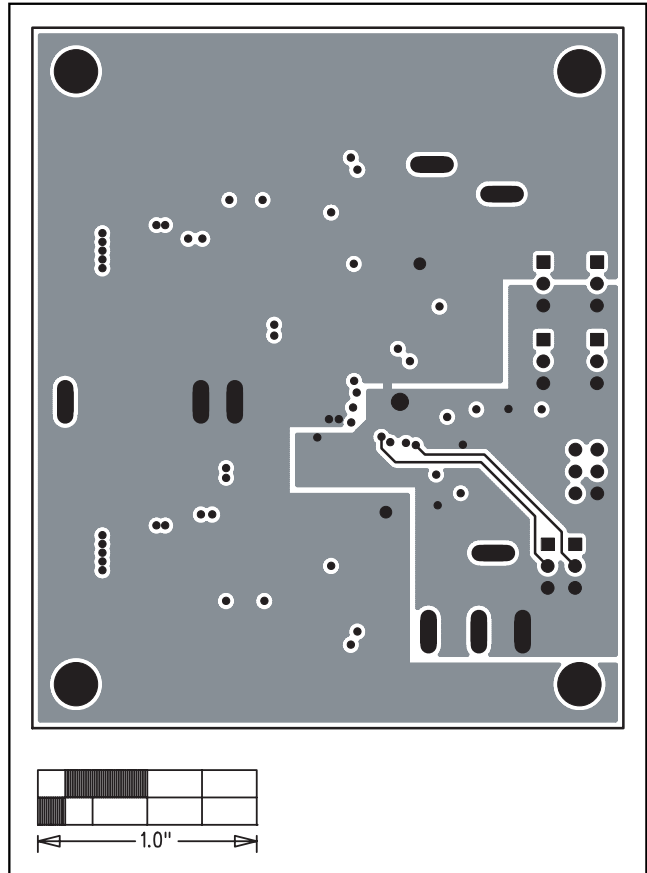


Figure 5. MAX1533 EV Kit PC Board Layout—Layer 3

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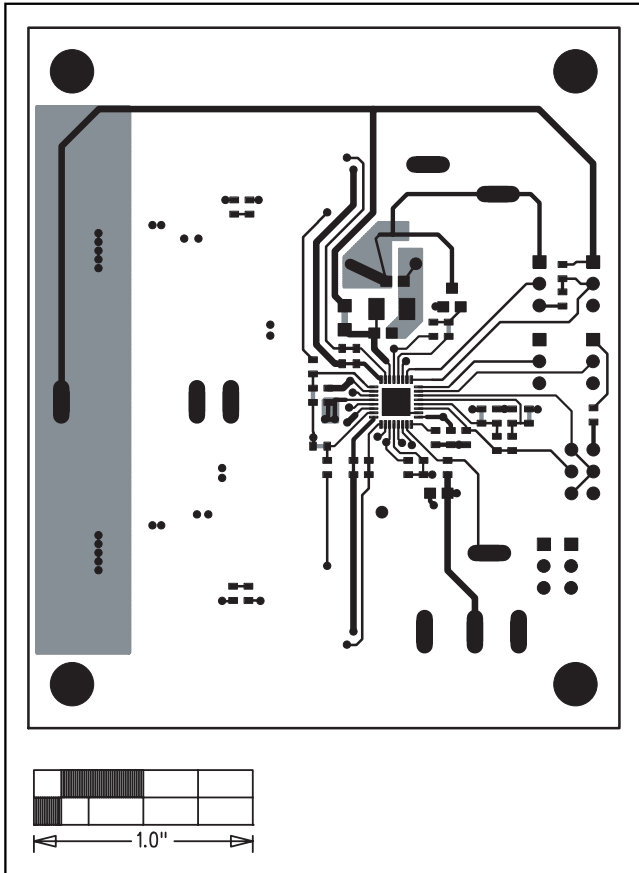


Figure 6. MAX1533 EV Kit PC Board Layout—Solder Side

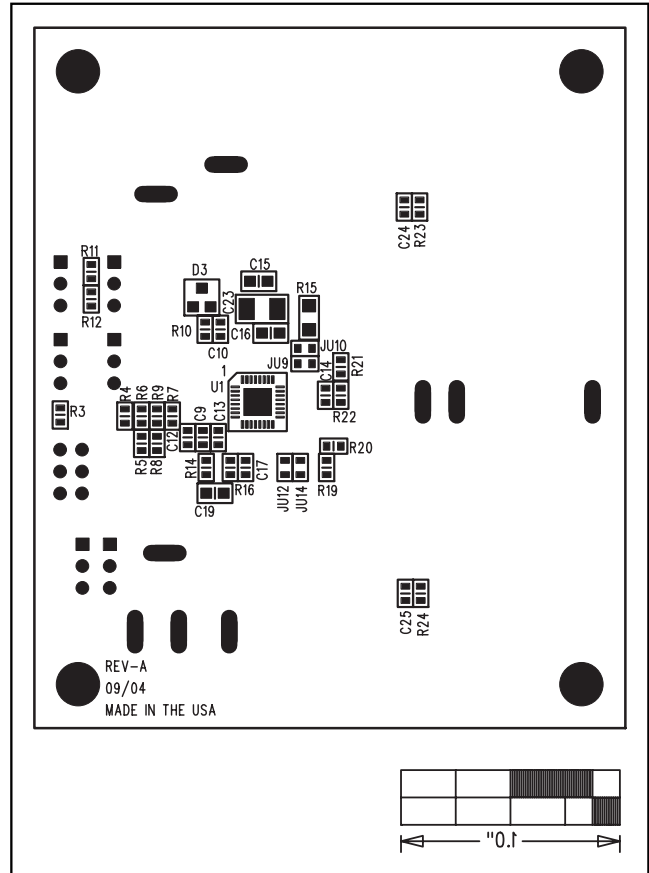


Figure 7. MAX1533 EV Kit Component Placement Guide—Solder Side

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