*Click here for production status of specific part numbers.*

# MAX77504 WLP Evaluation Kit

## Evaluates: MAX77504 (MAX77504AAWE+/MAX77504BAWE+)

## General Description

The MAX77504 evaluation kit (EV kit) provides a proven design to evaluate the MAX77504, a 3A high-efficiency buck converter. The IC is capable of 2.6V to 14V input and is output voltage configurable between 0.6V to 6V. The factory default output voltage of this EV kit is set at 3.3V. Output voltage can be configured by changing the feedback resistor values (R3 and R4). Two GPIO pins are available to support Force PWM and EN function.

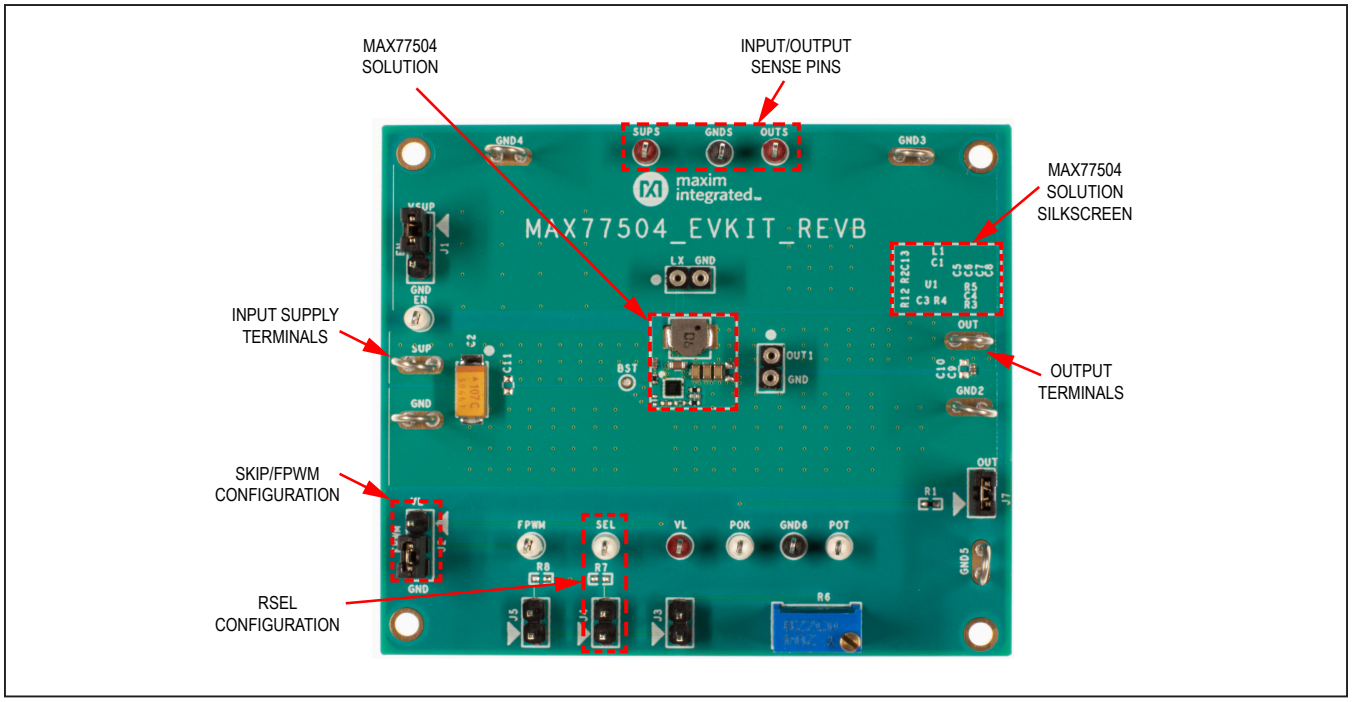
## Features and Default Settings

- Sense Points for High-Accuracy Measurements
- Accessible Test Points for EN, POK, FPWM, and OUTS
- Switching Frequency Configurable Between 500kHz to 1.5MHz Through SEL
- FPWM and Skip Mode Configurable (Skip Mode Default)
- UVLO Rising = 2.6V, UVLO Falling = 2.4V

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

| SPECIFICATION | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Input Voltage | | 2.6 | | 14 | V |
| Output Voltage | | 0.6 | | 6 | V |
| Default Output Voltage | R3 = 49.9kΩ, R4 = 11.1kΩ | | 3.3 | | V |
| Output Current | | 0 | | 3 | A |
| Peak Efficiency | $3.7V_{IN}$, $3.3V_{OUT}$, 300mA load | | | 97.6 | % |

## MAX77504 Evaluation Board






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## Quick Start

### Required Equipment

- MAX77504 EV kit
- Adjustable DC power supply with 14V and 3A capability
- Digital Multimeters

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. Use twisted wires of appropriate gauge (20AWG) that are as short as possible to connect the load and power sources.

1) Ensure that the EV kit has the correct jumper settings, as shown in Table 1.
2) Connect a DVM to the SUPS and GNDS sense pins to measure input voltage.
3) Connect a DVM to the OUTS and GNDS sense pins to measure output voltage.
4) Apply a power supply set to 0V (100mA current limit) across the VIN and PGND terminals of the EV kit. Turn the supply on and increase the voltage to 12V.
5) Confirm the DVM connected to OUTS and GNDS reads the default output voltage of the EV kit (3.3V).

## Description of Hardware

The MAX77504 EV kit demonstrates the MAX77504 buck converter. It regulates output from input voltage ranges from 2.6V to 14V. Configurable output range is from 0.6V to 6.0V with feedback resistors R3 and R4. The EV kit is suited with a general DC input. Table 1 lists jumpers and associated functions that are available on the EV kit.

## Design Procedure (Choosing RSEL)

The MAX77504 includes an RSEL pin to configure the switching frequency, mid-band gain, and active discharge on startup. The configuration selection resistor (RSEL) sets five bits of configuration options decoded in Table 2. Choose RSEL[4:0] carefully by following the procedure outlined in the *Design Procedure* section of the IC data sheet; or refer to the *Typical Application Circuits* section of the IC data sheet for a list of known good RSEL choices for common applications. Resistors with tolerance 1% (or better) should be chosen for R7, with nominal values specified in Table 3. Ensure proper resistor configuration by measuring the resistance across SEL and GND sense points.

## Table 1. Default Shunt Positions and Jumper Descriptions

| JUMPER | NODE OR FUNCTION | SHUNT POSITION | FUNCTION |
|---|---|---|---|
| J1 | EN | 1-2* | Connects EN to $V_{IN}$ (MAX77504 is enabled by default). |
| | | 2-3 | Connects EN to GND. |
| J2 | FPWM | 1-2 | Enables FPWM function. |
| | | 2-3* | Enables SKIP mode function. |
| J3 | RSEL | 1-2 | Potentiometer (R6) value configuration to set switching frequency, mid-band gain, and active discharge (Default RSEL = OPEN). |
| J4 | RSEL | 1-2 | Resistor (R7) value configuration to set switching frequency, mid-band gain, and active discharge (Default RSEL = OPEN). |
| J5 | RSEL | 1-2 | Resistor (R8) value configuration to set switching frequency, mid-band gain, and active discharge (Default RSEL = OPEN). |
| J7 | POK | 1-2* | Enables Power-OK indicator function. |

** Default position*

For example, choose a 30.9kΩ (1% TOL) resistor to program RSEL[4:0] to 0x16. 0x16 (0b10110) decodes with the following configuration:

- FSW[1:0] = 0b10 (1MHz switching frequency)
- GAIN[1:0] = 0b11 (200kΩ $R_{COMP}$)
- ADEN = 0b0 (active discharge disabled)

Table 3 indicates that a 30.9kΩ selection resistor selects code 0b10110 (0x16). The device evaluates $R_{SEL}$ whenever SUP is valid and EN transitions from logic 0 to 1. The decoded value of $R_{SEL}$ is latched until the next EN rising edge.

## Table 2. MAX77504 RSEL Configuration Bits

| RSEL[4:0] | | NAME | DESCRIPTION | DECODE |
|---|---|---|---|---|
| MSB | Bit 4 | FSW[1:0] | Switching Frequency Control. Sets $F_{SW}$. | 00 = 0.5MHz<br>01 = 0.75MHz<br>10 = 1.0MHz<br>11 = 1.5MHz |
| | Bit 3 | | | |
| | Bit 2 | GAIN[1:0] | Mid-band gain control. Sets $R_{COMP}$. | 00 = 75kΩ<br>01 = 100kΩ<br>10 = 150kΩ<br>11 = 200kΩ |
| | Bit 1 | | | |
| LSB | Bit 0 | ADEN | Active discharge resistor enable. | 0 = disabled<br>1 = enabled |
| *Program these bits by choosing a configuration selection resistor ($R_{SEL}$) with a tolerance of 1% or better using lookup Table 3.* | | | | |

## Table 3. Configuration Selection Resistor (RSEL) Lookup Table

| $R_{SEL}$ (Ω) → RSEL[4:0] | | |
|---|---|---|
| 95.3Ω or SHORT → 0x00 | 1620Ω → 0x0B | 30900Ω → 0x16 |
| 200Ω → 0x01 | 1870Ω → 0x0C | 36500Ω → 0x17 |
| 309Ω → 0x02 | 2150Ω → 0x0D | 42200Ω → 0x18 |
| 422Ω → 0x03 | 2490Ω → 0x0E | 48700Ω → 0x19 |
| 536Ω → 0x04 | 2870Ω → 0x0F | 56200Ω → 0x1A |
| 649Ω → 0x05 | 3740Ω → 0x10 | 64900Ω → 0x1B |
| 768Ω → 0x06 | 8060Ω → 0x11 | 75000Ω → 0x1C |
| 909Ω → 0x07 | 12400Ω → 0x12 | 86600Ω → 0x1D |
| 1050Ω → 0x08 | 16900Ω → 0x13 | 100000Ω → 0x1E |
| 1210Ω → 0x09 | 21500Ω → 0x14 | 115000Ω or OPEN → 0x1F |
| 1400Ω → 0x0A | 26100Ω → 0x15 | |

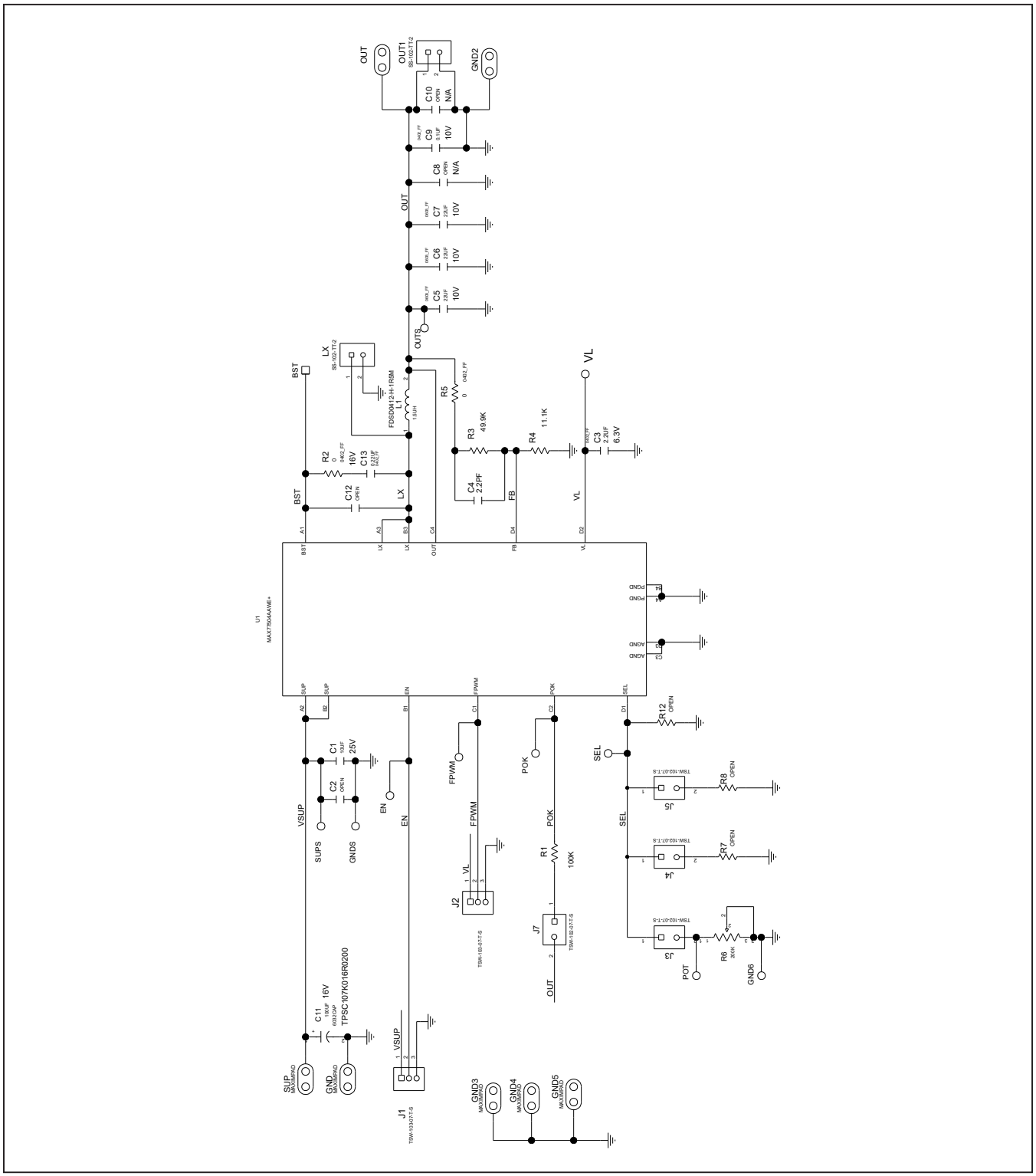
## Ordering Information

| PART | U1 IC | DEFAULT OUTPUT VOLTAGE | UVLO FALLING | UVLO RISING |
|---|---|---|---|---|
| MAX77504WEVKIT# | MAX77504AAWE+ | 3.3V | 2.4V | 2.6V |

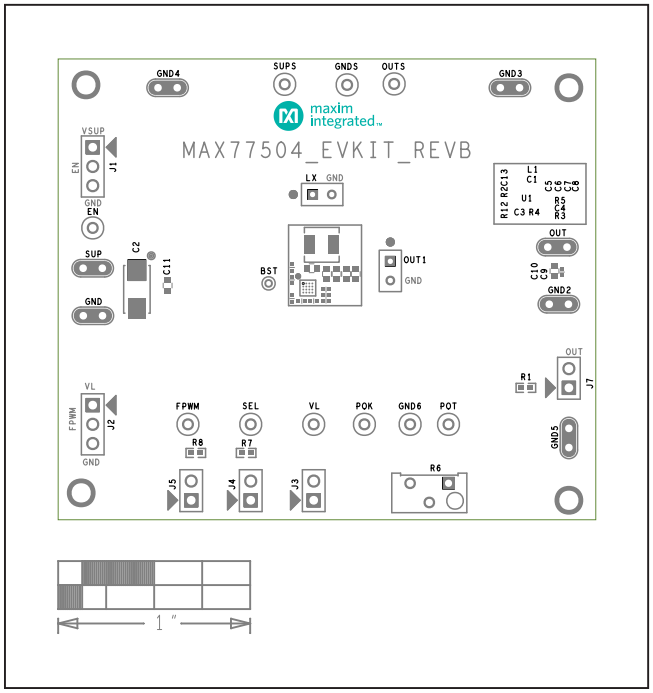
## MAX77504 EV Kit Bill of Materials

| PART | QTY | MFG PART # | MANUFACTURER | DESCRIPTION |
|---|---|---|---|---|
| C1 | 1 | C1608X5R1E106M080AC | TDK | 10µF ±10%, 10V X5R CERAMIC CAPACITOR (0603) |
| C3 | 1 | ANY | ANY | 2.2µF ±10%, 6.3V X5R CERAMIC CAPACITOR (0402) |
| C4 | 1 | GRM1555C1H2R2BA01 | MURATA | 2.2pF ±5%, 50V C0G CERAMIC CAPACITOR (0402) |
| C5, C6, C7 | 3 | C1608X5R1A226M080AC | TDK | 22µF ±20%, 10V X5R CERAMIC CAPACITOR (0603) |
| C13 | 1 | ANY | ANY | 0.22µF ±10%, 16V X7R CERAMIC CAPACITOR (0402) |
| J1, J2 | 2 | TSW-103-07-T-S | SAMTEC | STRAIGHT CONNECTOR, 3 PINS |
| J7 | 1 | TSW-102-07-T-S | SAMTEC | STRAIGHT CONNECTOR, 2 PINS |
| L1 | 1 | FDSD0412-H-1R5M | MURATA | 1.5µH ±20%, ISAT=5.5A, DCR=53mΩ |
| R2, R5 | 1 | ANY | ANY | 0Ω, RESISTOR (0402) |
| R3 | 1 | ERJ-2RKF4992 | PANASONIC | 49.9kΩ, RESISTOR (0402) |
| R4 | 1 | TNPW040211K1BE | VISHAY | 11.1kΩ, RESISTOR (0402) |
| U1 | 1 | MAX77504AAWE+ | MAXIM | BUCK (16 WLP), MAX77504AAWE+ |
| **Components below this line are outside of the immediate MAX77504 evaluation circuit and solution silkscreen.** | | | | |
| C9 | 1 | ANY | ANY | 0.1µF ±10%, 10V X5R CERAMIC CAPACITOR (0402) |
| C11 | 1 | TPSC107K016R0200 | AVX | 100µF ±10%, 16V TANTALUM CAPACITOR (6032) |
| EN, FPWM, POK, POT, SEL | 5 | 5002 | KEYSTONE | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER; |
| GND, GND2-GND5, OUT, SUP | 4 | 9020 BUSS | WEICO WIRE | EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG |
| J3, J4, J5 | 3 | TSW-102-07-T-S | SAMTEC | STRAIGHT CONNECTOR, 2 PINS |
| LX, OUT1 | 2 | SS-102-TT-2 | SAMTEC | IC-SOCKET; SIP; STRAIGHT; PRECISION MACHINED SOCKET STRIP; OPEN FRAME; 2PINS; 100MIL |
| OUTS, SUPS, VL | 3 | 5000 | KEYSTONE | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| R1 | 1 | CRCW0402100KFK | VISHAY | 100kΩ ±1%, RESISTOR (0402) |
| R6 | 1 | 3296Y-1-204LF | BOURNS | RESISTOR; THROUGH HOLE-RADIAL LEAD; 3296 SERIES; 200K OHM; 10%; 100PPM; 0.5W |
| PCB | 1 | MAX77504 SOLDERDOWN | MAXIM | PCB:MAX77504SOLDERDOWN |
| C2, C8, C10 | 0 | N/A | N/A | CAPACITOR; SMT (0603); OPEN; FORMFACTOR |
| C12 | 0 | N/A | N/A | CAPACITOR; SMT (0402); OPEN; FORMFACTOR |
| R7, R8, R12 | 0 | N/A | N/A | RESISTOR; 0402; OPEN; FORMFACTOR |

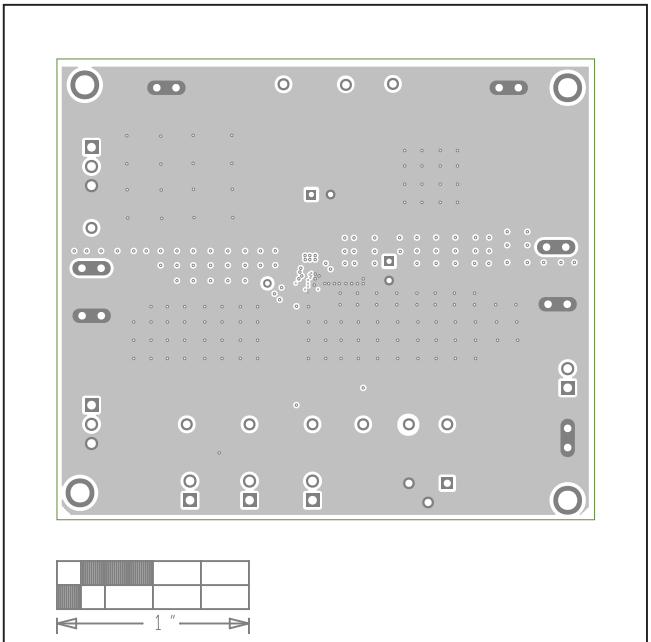
## MAX77504 EV Kit Schematic



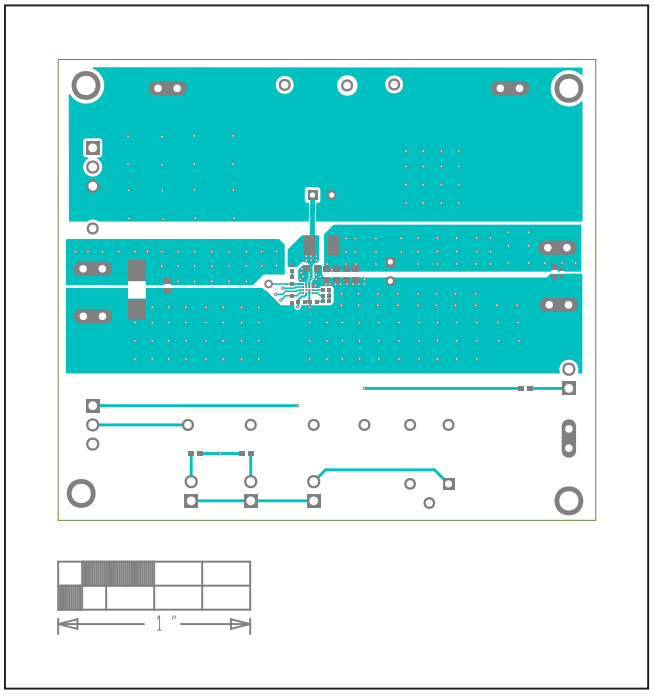
## MAX77504 EV Kit PCB Layout Diagrams



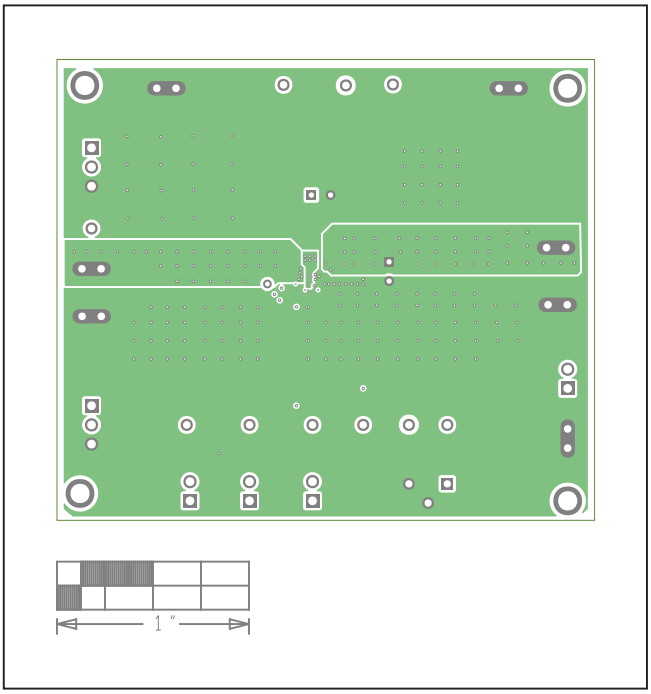

*MAX77504 EV Kit Component Placement Guide—Top Silkscreen*




*MAX77504 EV Kit PCB Layout—Internal 2*

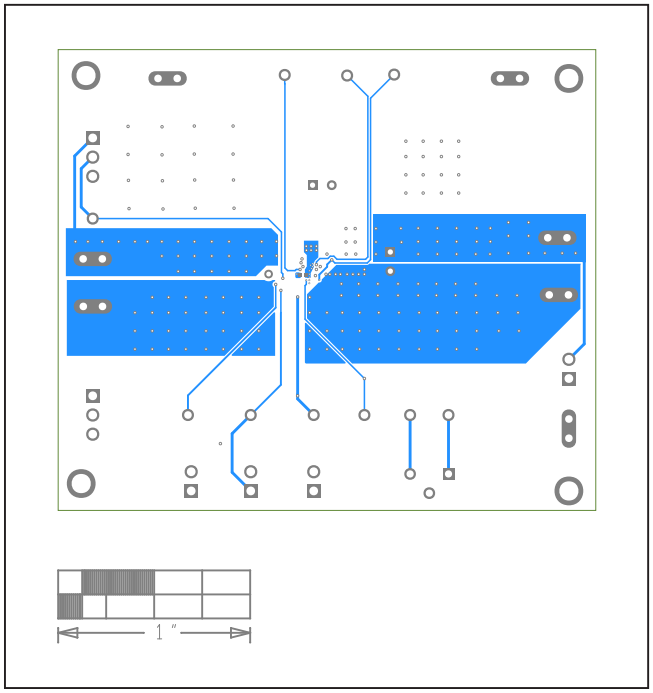



*MAX77504 EV Kit PCB Layout—Top*

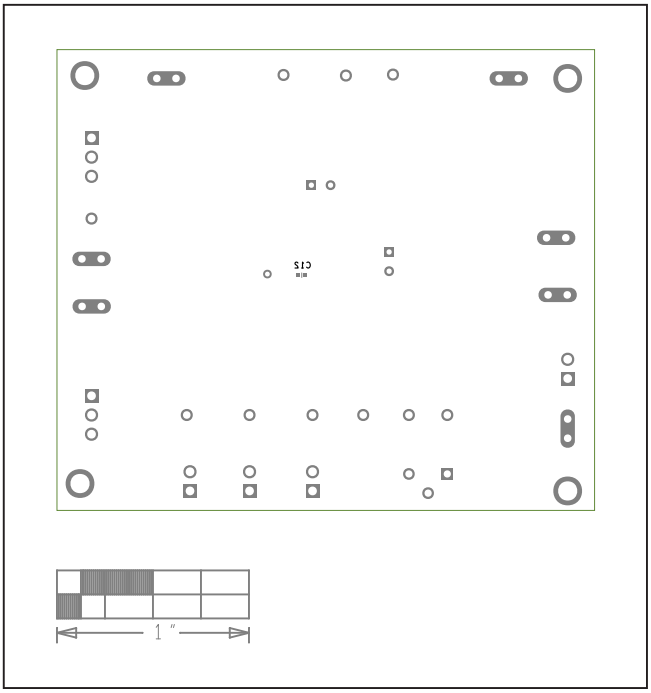



*MAX77504 EV Kit PCB Layout—Internal 3*

## MAX77504 EV Kit PCB Layout Diagrams (continued)




*MAX77504 EV Kit PCB Layout—Bottom*




*MAX77504 EV Kit Component Placement Guide—Bottom Silkscreen*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 11/19 | Initial release | — |

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