MAXM17624 3.3V Output Evaluation Kit

General Description

The MAXM17624 3.3V output evaluation kit (EV kit) provides a proven design to evaluate the MAXM17624 high frequency, high-efficiency, synchronous step-down DC-DC power module. The EV kit is programmed to deliver 3.3V output for loads up to 1A. The EV kit features selectable mode, and open-drain PGOOD signal. The MAXM17624 data sheet provides a complete description of the module that should be read in conjunction with this EV kit data sheet prior to modifying the demo circuit. For full module features, benefits and parameters, refer to the MAXM17624 data sheet.

Features

- Highly Integrated Solution
- 3.6V to 5.5V Input Range
- Programmed 3.3V Output, Delivers Up To 1A Output Current
- High 95.2% Efficiency
  (V_{IN} = 5V, V_{OUT} = 3.3V at 0.4A)
- 4MHz Switching Frequency
- PFM Feature for Better Light-Load Efficiency
- Fixed Internal 1ms Soft-Start Time
- PGOOD Output, with Pullup Resistor to V_{IN}
- Overcurrent and Overtemperature Protection (OCP and OTP)
- Low-Profile, Surface-Mount Components
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Recommended Equipment

- One 3.6V to 5.5V DC, 1A power supply
- One resistive load with 3.3V, 1A sink capacity
- One digital multimeter (DMM)
- MAXM17624EVKIT#

Equipment Setup and Test Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify the board operation.

Caution: Do not turn on power supply until all connections are completed.

1) Set the power supply at a voltage between 3.6V and 5.5V. Then, disable the power supply.

2) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad. Connect the positive terminal of the 1A load to the VOUT PCB pad and the negative terminal to the nearest PGND PCB pad.

3) Connect the DVM (DMM in voltage-measurement mode) across the VOUT PCB pad and the nearest PGND PCB pad.

4) Verify that shunt is installed in the default position on jumper J1 (see Table 1 for details).

5) Turn on the DC power supply.

6) Enable the load.

7) Verify that the DVM displays 3.3V.

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

Detailed Description

The MAXM17624 EV kit is designed to demonstrate salient features of MAXM17624 power module. The EV kit includes an EN PCB pad, and jumper J1, to enable the output. Jumper J2 allows selection of either PWM or PFM mode of operation based on light-load performance requirements. An additional PGOOD pad is available for monitoring if the converter output voltage is in regulation.

Output Capacitor Selection

X7R ceramic output capacitors are preferred due to their stability over temperature in industrial applications. The required output capacitor (C4) for 3.3V output is selected from Table 1 of the *MAXM17624* data sheet as 10µF/16V.

Adjusting Output Voltage

The MAXM17624 supports an adjustable output-voltage range, from 1.5V to 3.3V, using a feedback resistive divider from V_{OUT} to FB. Output voltage can be programmed using the values given in Table 1 of the *MAXM17624* data sheet. For 3.3V output, R1 is chosen as 118kΩ, and R2 is chosen as 37.4kΩ.

Input Capacitor Selection

The input capacitor serves to reduce the current peaks drawn from the input power supply and reduces switching frequency ripple at the input. The input capacitance must be greater than or equal to the value given in Table 1 of the *MAXM17624* data sheet. Input capacitor C3 is chosen to be 2.2µF/10V.

Hot-Plug-In and Long Input Cables

The MAXM17624 EV kit PCB provides an optional Tantalum capacitor (C2, 47µF/8V) to dampen input voltage peaks and oscillations that can arise during hot-plug-in and/or due to long input cables. This capacitor limits the peak voltage at the input of the MAXM17624 power module, when the EV kit is powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables, between input power source and the EV kit circuit can cause input-voltage oscillations due to the inductance of the cables. The equivalent series resistance (ESR) of the Tantalum capacitor helps damp out the oscillations caused by long input cables. Further, capacitor C1 (0.1µF/100V), placed near the input of the board, helps in attenuating high frequency noise.

Mode of Operation

The MAXM17624 features PFM mode of operation to increase the efficiency at light-load condition. If the MODE pin is left unconnected during powerup, the module operates in PFM mode at light loads. If the MODE pin is connected to SGND during power-up, the part operates in constant-frequency PWM mode at all loads. See Table 2 for J2 settings.

Table 1. Enable/Disable Configuration (J1)

POSITION	EN PIN	MAXM17624 OUTPUT
1-2*	Connected to V_{IN}	Enabled if V_{IN} is greater than V_{EN_HIGH}.
2-3	Connected to SGND	Disabled

Default position

Table 2. Mode of Operation (J2)

POSITION	MODE PIN
1-2	Operates in PWM mode at all load conditions.
Not Installed*	Operates in PFM mode at light-load conditions.

Default position

EV Kit Performance Report
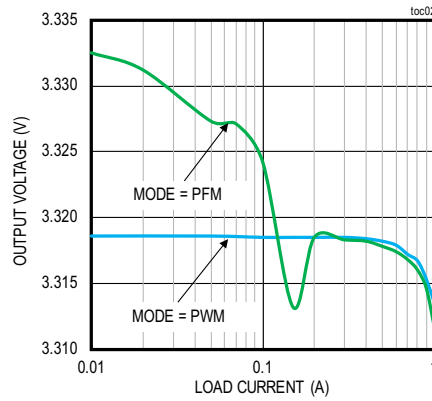
MAXM17624 EFFICIENCY vs. LOAD CURRENT
V_{IN} = 5V, V_{OUT} = 3.3V, PWM AND PFM MODE

toc01

MODE = PFM

MODE = PWM

EFFICIENCY (%)
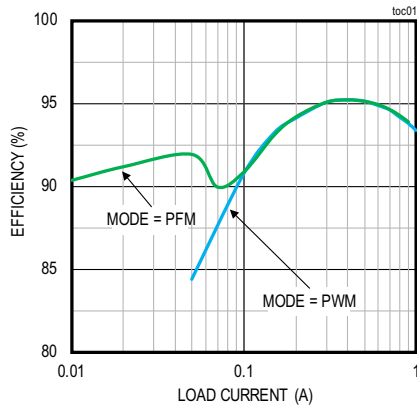
LOAD CURRENT (A)

MAXM17624 OUTPUT VOLTAGE vs. LOAD CURRENT
V_{IN} = 5V, V_{OUT} = 3.3V, PWM AND PFM MODE

toc02

MODE = PFM

MODE = PWM

OUTPUT VOLTAGE (V)

LOAD CURRENT (A)

MAXM17624 BODE PLOT
V_{IN} = 5V, V_{OUT} = 3.3V, FULL LOAD, PWM MODE

toc03

MAGNITUDE

PHASE

CROSSOVER FREQUENCY = 123.829kHz
PHASE MARGIN = 63.213°

GIAN MAGNITUDE (dB)

GAIN PHASE (°)

FREQUENCY (Hz)
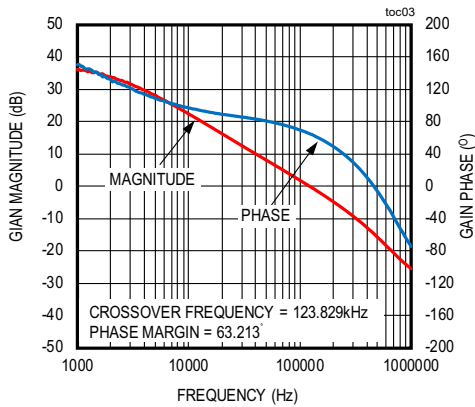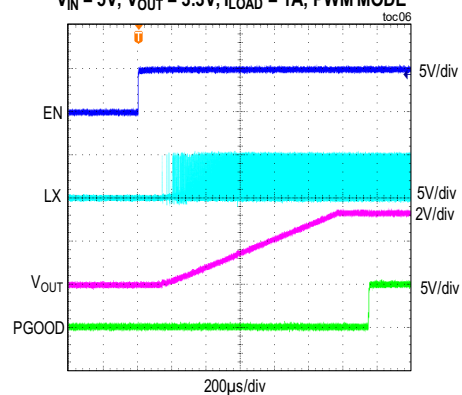
MAXM17624 LOAD TRANSIENT RESPONSE
V_{IN} = 5V, V_{OUT} = 3.3V, PWM MODE
(LOAD CURRENT STEPPED FROM 0.5 TO 1A)

toc04

V_{OUT}
(AC)

50mV/div

I_{OUT}

500mA/div

40µs/div
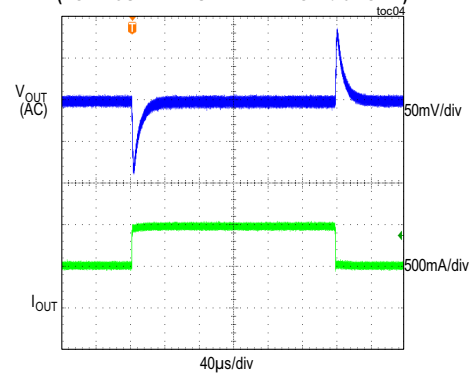
MAXM17624 LOAD TRANSIENT RESPONSE
V_{IN} = 5V, V_{OUT} = 3.3V, PFM MODE
(LOAD CURRENT STEPPED FROM 0A TO 500mA)

toc05

V_{OUT}
(AC)

100mV/div

I_{OUT}

500mA/div

40µs/div
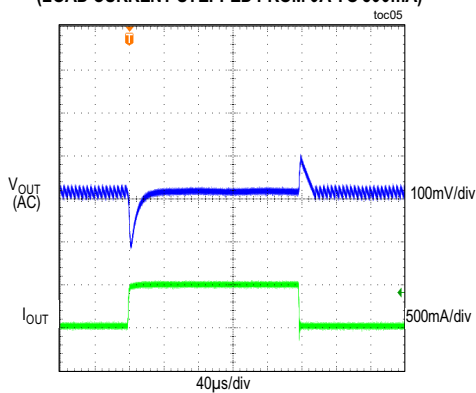
MAXM17624 STARTUP THROUGH ENABLE
V_{IN} = 5V, V_{OUT} = 3.3V, I_{LOAD} = 1A, PWM MODE

toc06

EN

5V/div

LX

5V/div

2V/div

V_{OUT}

5V/div

PGOOD

200µs/div

EV Kit Performance Report (continued)

MAXM17624 SHUTDOWN THROUGH ENABLE
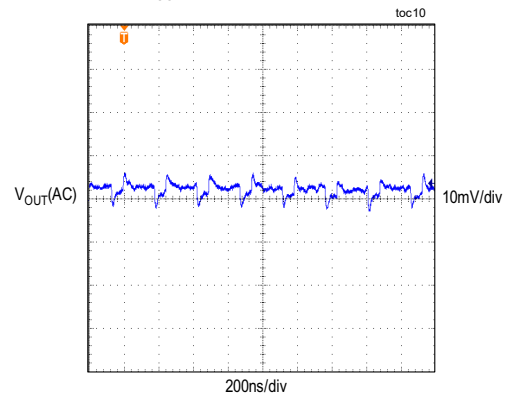V_{IN} = 5V, V_{OUT} = 3.3V, I_{LOAD} = 1A, PWM MODE

toc07

EN — 5V/div
LX — 5V/div
V_{OUT} — 2V/div
PGOOD — 5V/div

20µs/div
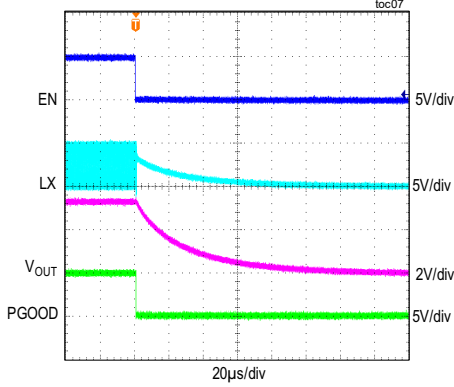
MAXM17624 TEMPORARY OUTPUT SHORT
V_{IN} = 5V, V_{OUT} = 3.3V, I_{LOAD} = 1A, PWM MODE

toc08

SHORT — 5V/div
V_{OUT} — 2V/div
V_{LX} — 5V/div
I_{OUT} — 1A/div

100µs/div
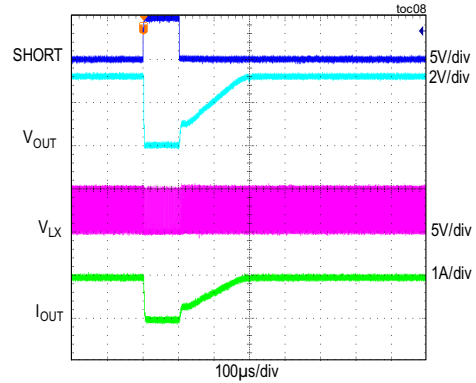
MAXM17624 STARTUP INTO PREBIAS
V_{IN} = 5V, $V_{PREBIAS}$ = 2.5V, V_{OUT} = 3.3V, I_{LOAD} = 1A, PWM MODE
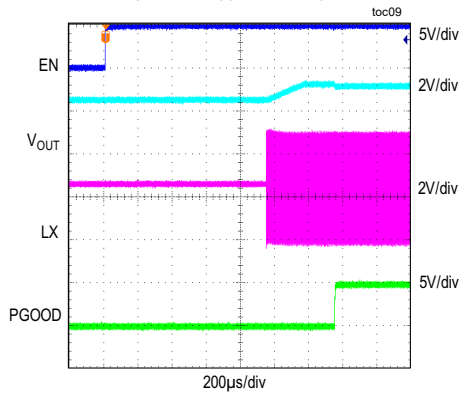
toc09

EN — 5V/div
V_{OUT} — 2V/div
LX — 2V/div
PGOOD — 5V/div

200µs/div

MAXM17624 OUTPUT VOLTAGE RIPPLE
V_{IN} = 5V, V_{OUT} = 3.3V, I_{LOAD} = 1A, PWM MODE

toc10

V_{OUT}(AC) — 10mV/div

200ns/div

MAXM17624 OUTPUT VOLTAGE RIPPLE
V_{IN} = 5V, V_{OUT} = 3.3V, I_{LOAD} = 0A, PFM MODE

toc11

V_{OUT}(AC) — 20mV/div

10ms/div
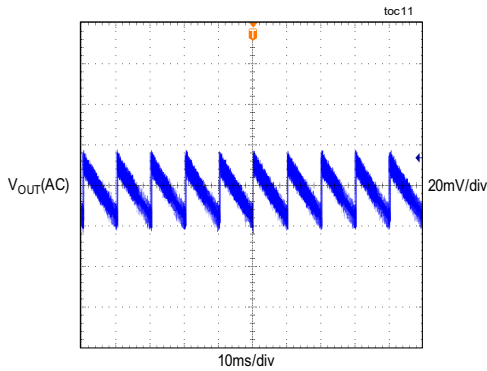
**MAXM17624 OUTPUT CURRENT
vs. AMBIENT TEMPERATURE**
V_{IN} = 5V V_{OUT} = 3.3V
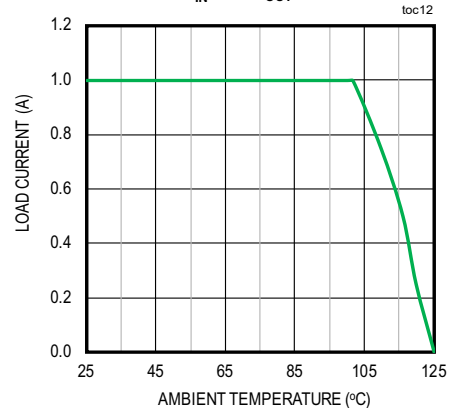
toc12

LOAD CURRENT (A) vs AMBIENT TEMPERATURE (ºC)

Ordering Information

PART	TYPE
MAXM17624EVKIT#	EV Kit

#Denotes RoHS compliant.

## Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com
TDK Corp.	www.component.tdk.com
Yageo	www.yageo.com

**Note:** *Indicate that you are using the MAXM17624 when contacting these component suppliers.*

MAXM17624 3.3V EV Kit Bill of Materials

| Item	Quantity	Designation	Description	Manufacturer Part No.
1	2	C1, C6	0.1µF±10%, 10V, X7R, ceramic capacitor (0402)	TDK C1005X5R1A104K
2	1	C2	47µF±20%, 8V, Tantalum capacitor (3528)	Kemet T520B476M008ATE035
3	1	C3	2.2µF±10%, 10V, X7R, ceramic capacitor (0603)	Murata GRM188R71A225KE15
4	1	C4	10µF±10%, 16V, X7R, ceramic capacitor (0805)	Murata GRM21BZ71C106KE15
5	1	R1	118kΩ±1% resistor (0402)	Yageo RC0402FR-07118KL
6	1	R2	37.4kΩ±1% resistor (0402)	Yageo RC0402FR-0737K4L
7	1	R3	100kΩ±1% resistor (0402)	Panasonic ERJ-2RKF1003X
8	1	U1	MAXM17624 10pin u-SLIC Power Module	Maxim MAXM17624AMB+
9	1	PCB	MAXM17624 EVKIT PCB	-
10	1	JU1	Jumper pins	Sullins PBC03SAAN
11	1	JU2	Jumper pins	Sullins PBC02SAAN
12	2	SU1, SU2	Jumper heads	Sullins NPB02SVAN-RC
13	6	EN, VIN, PGND, VOUT, PGND1, PGOOD	Test Loops	Weico Wire 9020 BUSS

MAXM17624 3.3V EV Kit Schematic
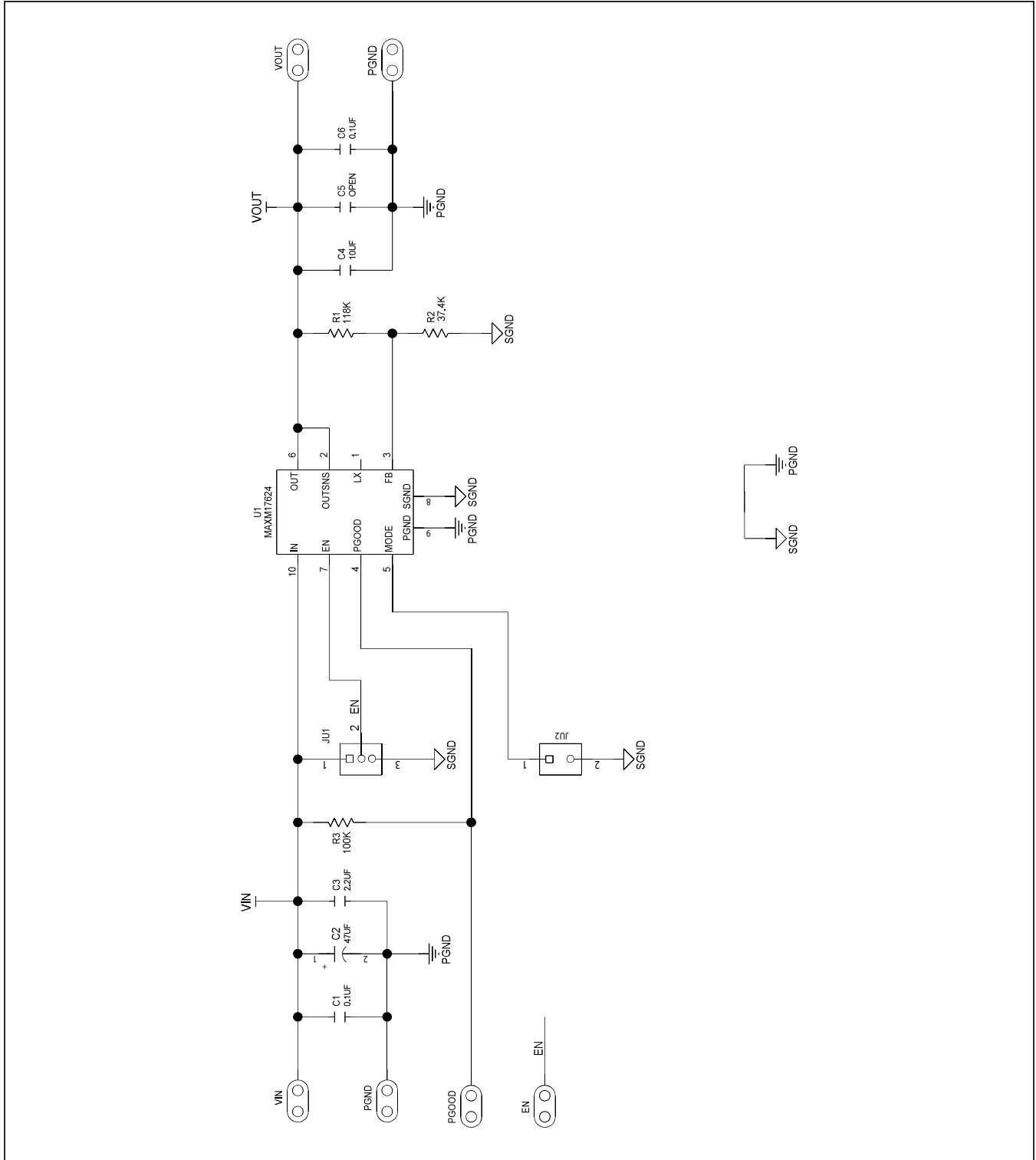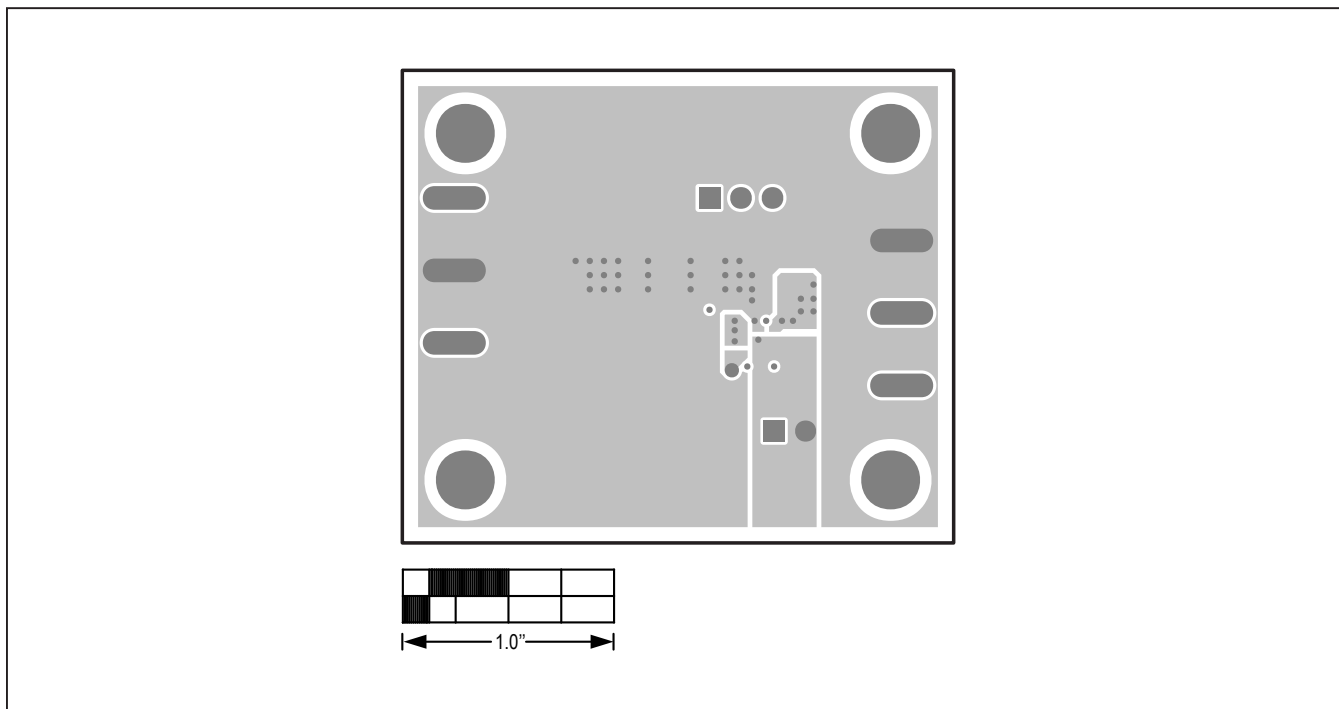
MAXM17624 3.3V EV Kit PCB Layout Diagrams
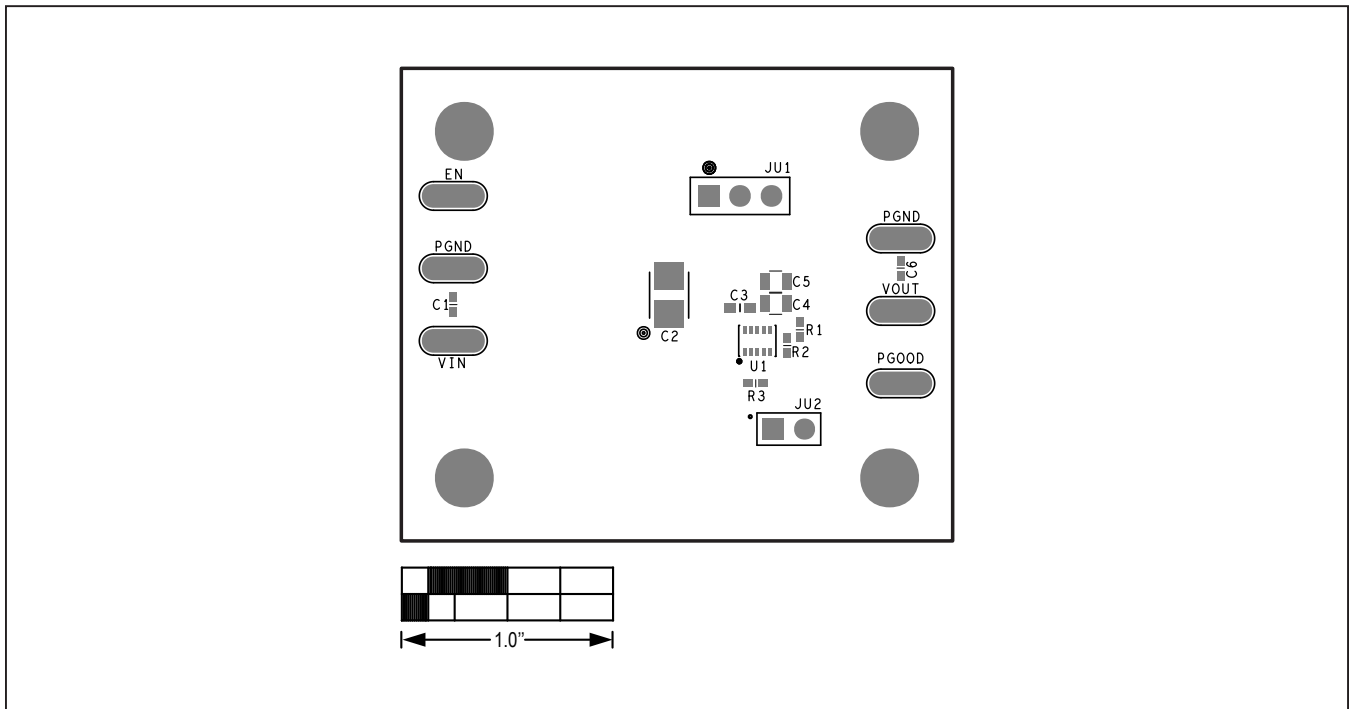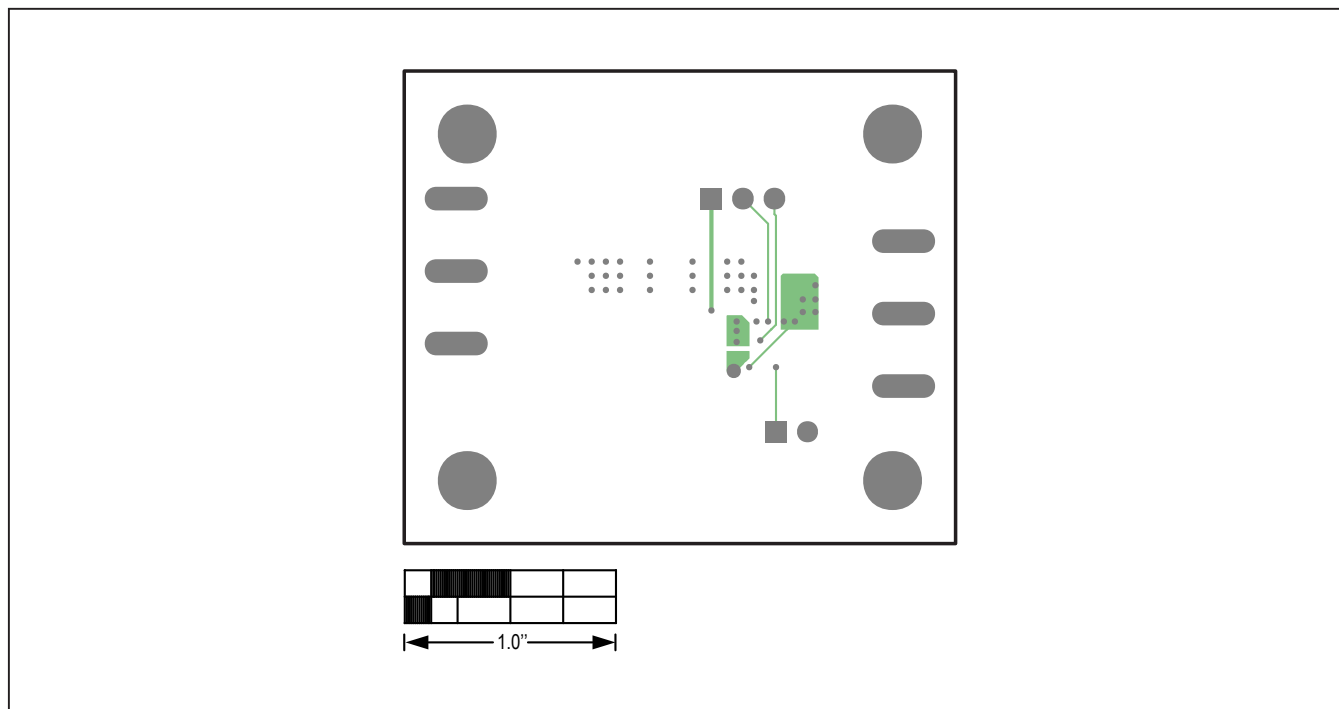

MAXM17624 EV Kit PCB Layout—Silk Top
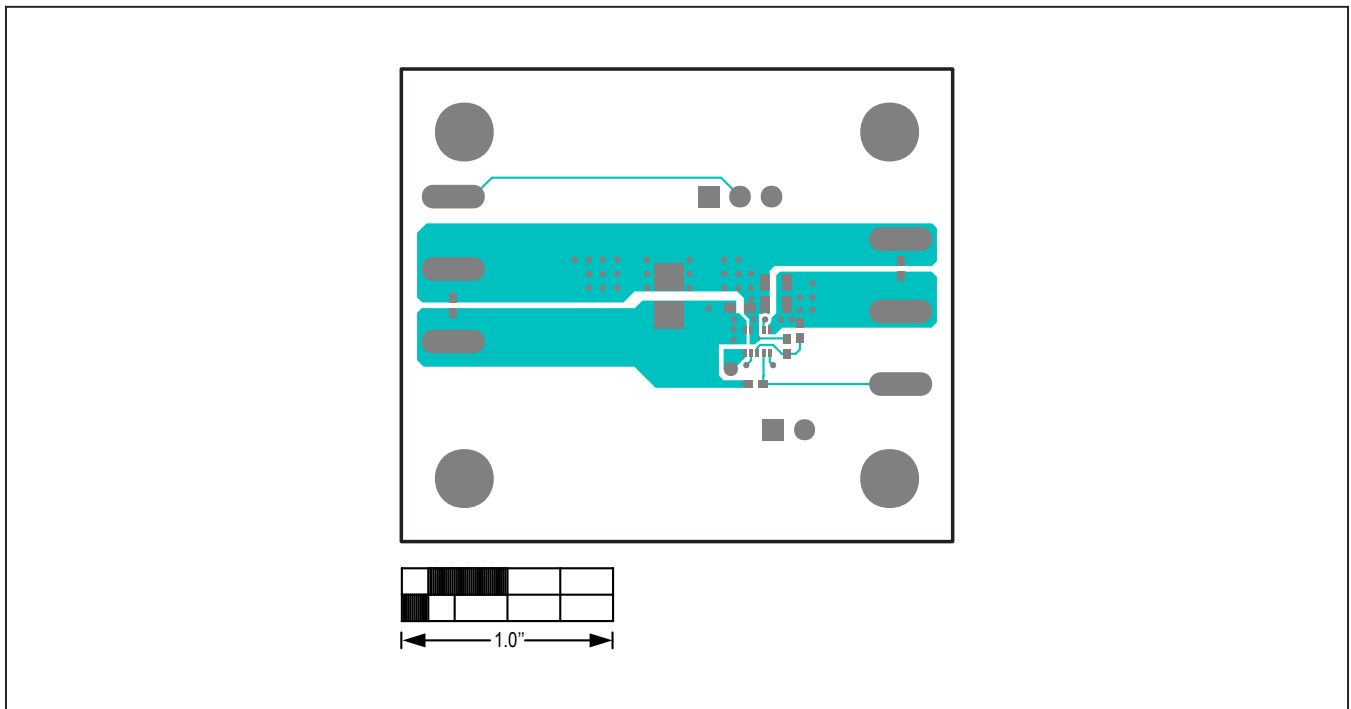
MAXM17624 EV Kit PCB Layout—Top Layer

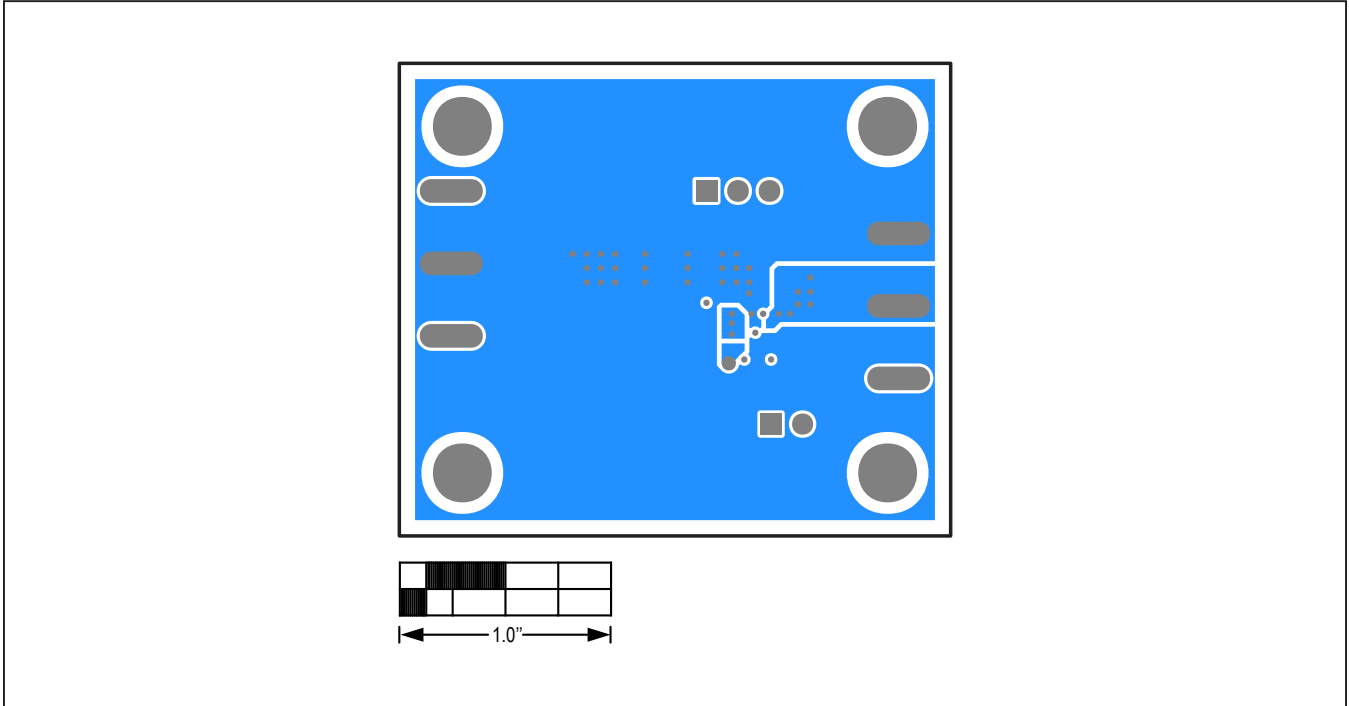## MAXM17624 3.3V EV Kit PCB Layout Diagrams (continued)

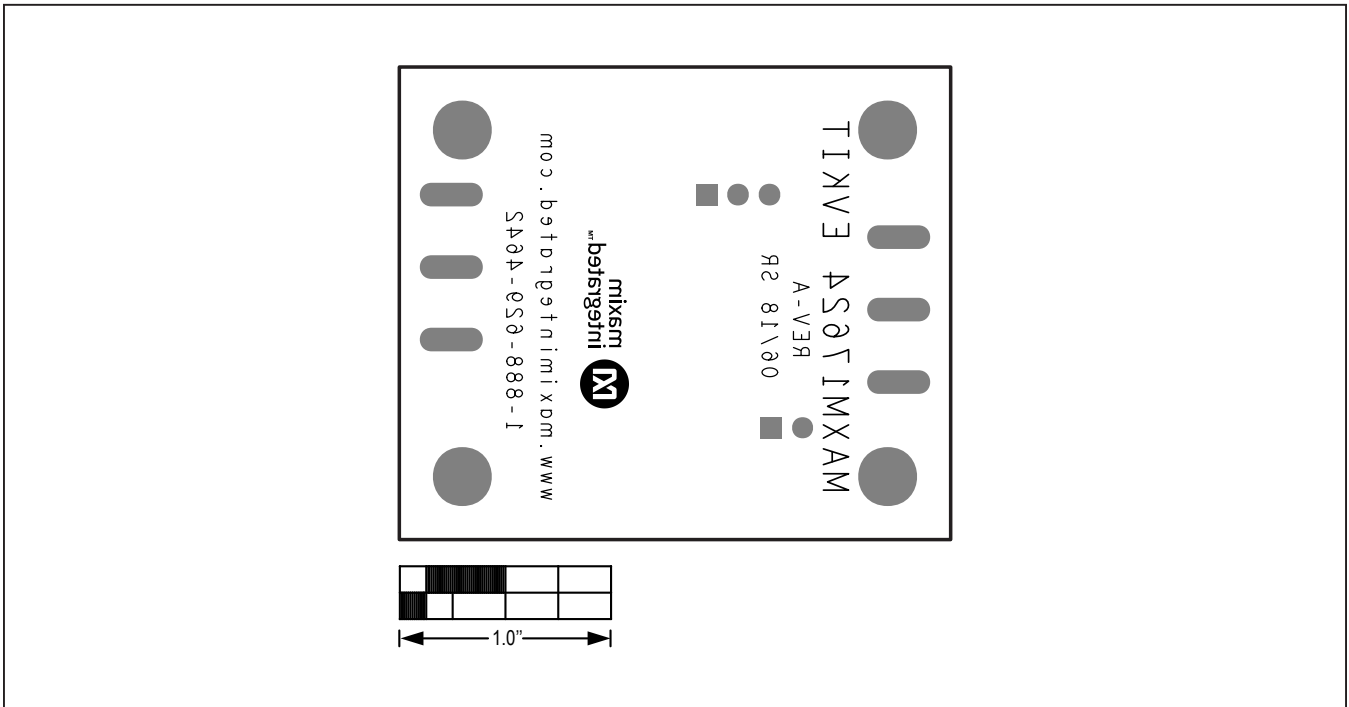MAXM17624 EV Kit PCB Layout—Layer 2 Ground

MAXM17624 EV Kit PCB Layout—Layer 3 Power

MAXM17624 3.3V EV Kit PCB Layout Diagrams (continued)

MAXM17624 EV Kit PCB Layout—Bottom Layer

MAXM17624 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/19	Initial release	—
1	8/19	Updated TOC1–TOC02 and TOC12	3–4
2	1/20	Updated the *Recommended Equipment, Equipment Setup and Test Procedure, Mode of Operation*, and *MAXM17624 3.3V EV Kit Bill of Materials* sections; updated Table 1, and TOC09, TOC11 and TOC12	1–2, 4–5

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