MAXM17552 Evaluation Kit

**Evaluates: MAXM17552
5V Output-Voltage Application**

General Description

The MAXM17552 evaluation kit (EV kit) is a demonstration circuit of the MAXM17552 ultra-small, high efficiency, current mode, synchronous step-down DC-DC switching power module. The EV kit operates over a wide input-voltage of 14V to 60V and provides up to 100mA load current with a 5V output voltage. The EV kit is programmed to switch at a frequency of 450kHz. The module is simple to use and easily configurable with minimal external components. It features cycle-by-cycle peak current-limit protection, undervoltage lockout (EN/UVLO), and thermal shutdown.

The EV kit comes with the compact 10-pin 2.6mm x 3mm x 1.5mm uSLIC™ package MAXM17552 module installed, and is rated to operate over the full industrial/automotive -40°C to +125°C temperature range. For full specifications, features and benifits of the IC, refer to the MAXM17552 data sheet.

Features

- Wide 14V to 60V Input
- ±1.75% Feedback Voltage Accuracy
- Output: 5V,100mA
- Internally Compensated
- All Ceramic Capacitors and Ultra-Compact Solution
- PFM or Forced-PWM Mode of Operation
- Shutdown Current as Low as 1.2µA (typ)
- Programmable Soft-Start and Prebias Startup
- Open-Drain Power Good Output ($\overline{RESET}$ pin)
- Programmable EN/UVLO Threshold
- Hiccup Overcurrent Protection (OCP)
- Overtemperature Protection (OTP)
- -40°C to +125°C Industrial/Automotive Temperature Range
- Complies with CISPR22 (EN55022) Class B Conducted and Radiated Emissions
- Passes Drop, Shock, and Vibration Standards— JESD22–B103, B104, B111

Quick Start

Recommended Equipment

- MAXM17552EVKIT#, MAXM17552 evaluation kit
- 60V DC power supply
- Dummy load capable of sinking 100mA
- Digital voltmeter (DVM)
- 100MHz dual-trace oscilloscope

Procedure

The MAXM17552 EV kit is fully assembled and tested. Please follow the steps below to verify the board operation. **Caution: Do not turn on the power supply until all connections are completed.**

1) Set the power supply at a voltage between 14V and 60V. Disable the power supply.

2) Connect the positive and negative terminals of the power supply to VIN and GND PCB pads, respectively.

3) Connect the positive and negative terminals of the 100mA load to VOUT and GND PCB pads respectively, and the set the load to 0A.

4) Connect the DVM across the VOUT PCB pad and the GND PCB pad closest to VOUT PCB pad.

5) Enable the input power supply.

6) Verify the DVM across output display 5V.

7) Increase the load up to 100mA to verify the output voltage is 5V using DVM.

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

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Detailed Description of Hardware

The MAXM17552 EV kit is a proven circuit to demonstrate the high-voltage, high-efficiency, and compact solution size of the MAXM17552 synchronous step-down DC-DC power module. The output voltage is preset to 5V to operate from 14V to 60V input and provides up to 100mA load current. The optimal frequency is set at 450kHz to maximize efficiency and minimize component size. The EV kit includes two test points, TP1 for monitoring the LX and TP2 for measuring the $\overline{RESET}$ voltage.

Soft-Start Input (SS)

The module offers a fixed 5.1ms internal soft-start when the SS pin is left unconnected. When adjustable soft-start time is required, connect a capacitor from SS to GND to program the soft-start time. The minimum soft-start time is related to the output capacitance (C_{OUT}) and the output voltage (V_{OUT}) by the following equation:

$$t_{SS} > 0.05 \times C_{OUT} \times V_{OUT}$$

where t_{SS} is in milliseconds and C_{OUT} is in µF.

Soft-start time (t_{SS}) is related to the capacitor connected at SS (C_3) by the following equation:

$$C_3 = 6.25 \times t_{SS}$$

where t_{SS} is in ms and C_3 is in nF.

Mode Selection (MODE)

The device features a MODE pin for selecting either forced-PWM or PFM mode of operation. If the MODE pin is left unconnected, the device operates in PFM mode at light loads. If the MODE pin is grounded, the device operates in a constant-frequency forced-PWM mode at all loads. The mode of operation cannot be changed on-the-fly during normal operation of the device. Refer to the MAXM17552 module datasheet for more information on the PWM and PFM modes of operation. Table 1 shows EV kit jumper settings that can be used to configure the desired mode of operation.

External Synchronization (RT/SYNC)

The RT/SYNC pin can be used to synchronize module's internal oscillator to an external system clock. Refer to the *External Synchronization* section in the **MAXM17552 data sheet** for additional information on configuring the external clock synchronization.
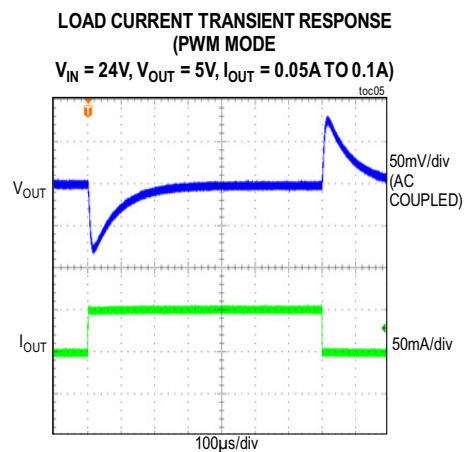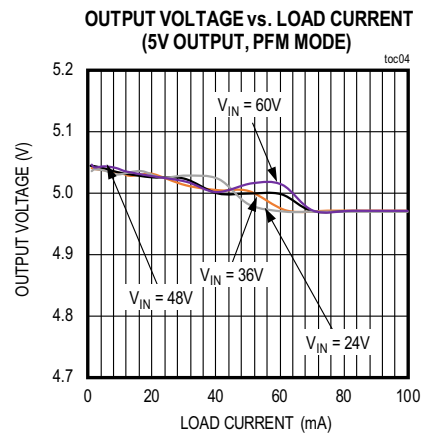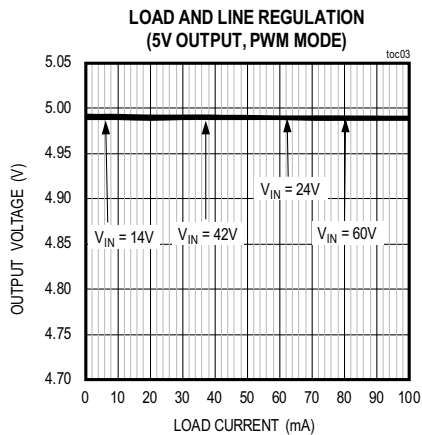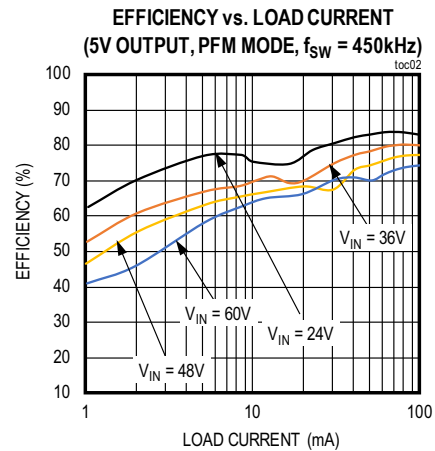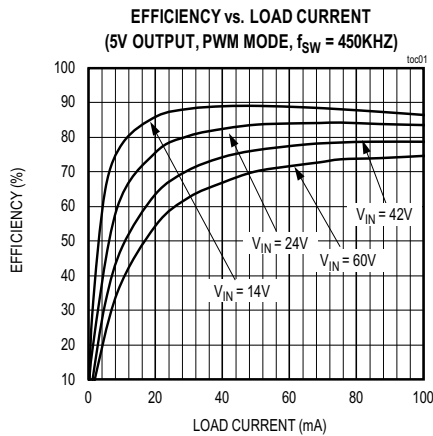
Reset Output ($\overline{RESET}$)

The module includes an open-drain $\overline{RESET}$ output to monitor output voltage. $\overline{RESET}$ should be pulled up with an external resistor to the desired external power supply less than or equal to 5.5V. $\overline{RESET}$ goes high-impedance 2ms after the output rises above 95% of its nominal set value and pulls low when the output voltage falls below 92% of the set nominal output voltage. $\overline{RESET}$ asserts low during the hiccup timeout period. In this EV kit, R7 resistor is used to pull up the $\overline{RESET}$ to the output voltage.

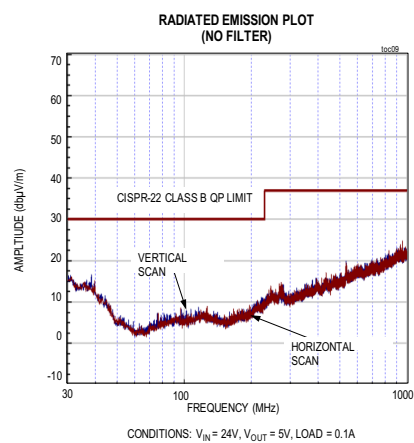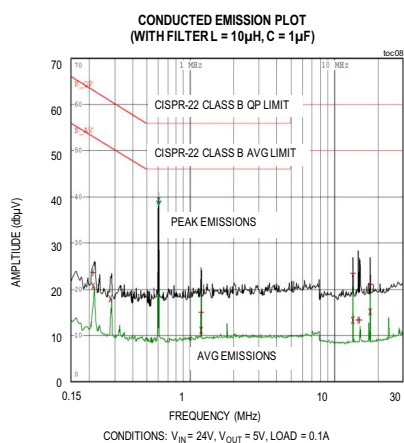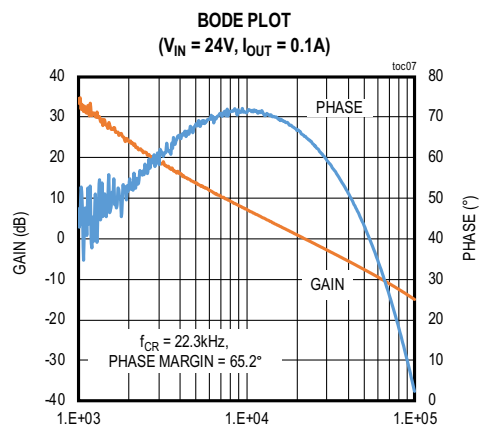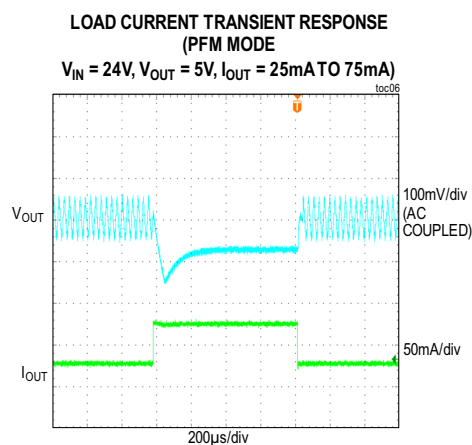## Table 1. Mode Configuration (JU1)

JU1 POSITION	MODE PIN	MAXM17552 OPERATION
1-2	Connected to GND	PWM mode
Not Installed	Open	PFM mode

EV Kit Performance Report

EFFICIENCY vs. LOAD CURRENT
(5V OUTPUT, PWM MODE, f_{SW} = 450KHZ)

toc01

V_{IN} = 42V
V_{IN} = 24V
V_{IN} = 60V
V_{IN} = 14V

EFFICIENCY (%)
LOAD CURRENT (mA)

EFFICIENCY vs. LOAD CURRENT
(5V OUTPUT, PFM MODE, f_{SW} = 450kHz)

toc02

V_{IN} = 36V
V_{IN} = 60V
V_{IN} = 24V
V_{IN} = 48V

EFFICIENCY (%)
LOAD CURRENT (mA)

LOAD AND LINE REGULATION
(5V OUTPUT, PWM MODE)

toc03

V_{IN} = 24V
V_{IN} = 14V
V_{IN} = 42V
V_{IN} = 60V

OUTPUT VOLTAGE (V)
LOAD CURRENT (mA)

OUTPUT VOLTAGE vs. LOAD CURRENT
(5V OUTPUT, PFM MODE)

toc04

V_{IN} = 60V
V_{IN} = 36V
V_{IN} = 48V
V_{IN} = 24V

OUTPUT VOLTAGE (V)
LOAD CURRENT (mA)

LOAD CURRENT TRANSIENT RESPONSE
(PWM MODE
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.05A TO 0.1A)

toc05

V_{OUT}
50mV/div
(AC
COUPLED)

I_{OUT}
50mA/div

100µs/div

EV Kit Performance Report (continued)

**LOAD CURRENT TRANSIENT RESPONSE
(PFM MODE
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 25mA TO 75mA)**

**BODE PLOT
(V_{IN} = 24V, I_{OUT} = 0.1A)**

**CONDUCTED EMISSION PLOT
(WITH FILTER L = 10µH, C = 1µF)**

CONDITIONS: V_{IN} = 24V, V_{OUT} = 5V, LOAD = 0.1A

**RADIATED EMISSION PLOT
(NO FILTER)**

CONDITIONS: V_{IN} = 24V, V_{OUT} = 5V, LOAD = 0.1A

MAXM17552 EV Kit Bill of Materials

| ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	C1	1	C2012X7S2A105K125	TDK	1UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7S
2	C2	1	GRM21BZ71E106KE15	MURATA	10UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R
3	C5	1	EEE-FK1J220XP	PANASONIC	22UF	CAPACITOR; SMT (CASE_D8); ALUMINUM-ELECTROLYTIC; 22UF; 63V; TOL=20%; TG=-55 DEGC TO +105 DEGC; AUTO
4	C7, C11	2	GCM155R71H104KE02	MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R
5	R1	1	CRCW0402261KFK	VISHAY DALE	261K	RESISTOR; 0402; 261K OHM; 1%; 100PPM; 0.063W; METAL FILM
6	R2	1	CRCW040249K9FK	VISHAY DALE	49.9K	RESISTOR; 0402; 49.9K; 1%; 100PPM; 0.0625W; THICK FILM
7	R3	1	CRCW040293K1FKED	VISHAY DALE	93.1K	RESISTOR; 0402; 93.1K OHM; 1%; 100PPM; 0.063W; METAL FILM
8	R4	1	RC0402JR-070RL	YAGEO PHYCOMP	0	RESISTOR; 0402; 0 OHM; 5%; JUMPER; 0.063W; THICK FILM
9	R7	1	ERJ-2RKF1003X	PANASONIC	100K	RESISTOR; 0402; 100K OHM; 1%; 100PPM; 0.10W; THICK FILM
10	U1	1	MAXM17552AMB+	MAXIM	MAXM17552AMB+	EVKIT PART-IC; COMPACT HIGH VOLTAGE; HIGH-EFFICIENCY STEP-DOWN POWER MODULE; PKG. CODE: M102A3+1
11	C3	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0402 NON-POLAR CAPACITOR
12	C4	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0805 NON-POLAR CAPACITOR
13	R5	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0402 RESISTOR

Ordering Information

PART	TYPE
MAXM17552EVKIT#	EV KIT

#Denotes RoHS compliant.

Component Suppliers

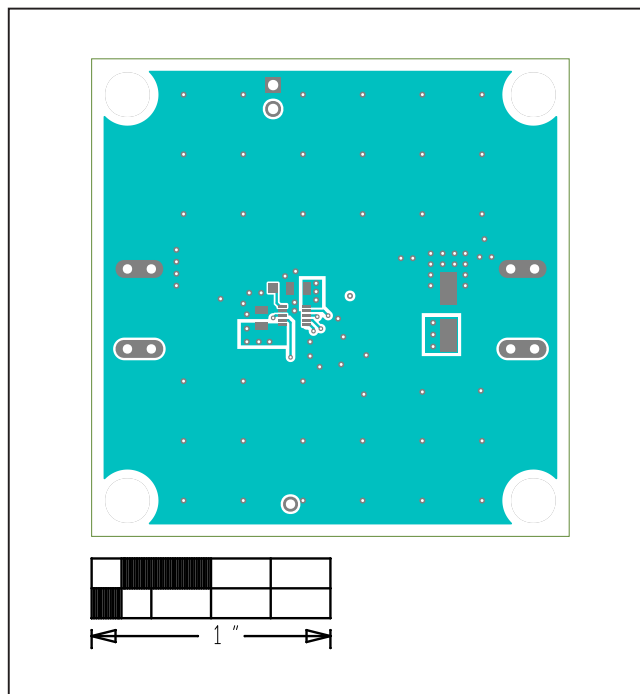| SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com

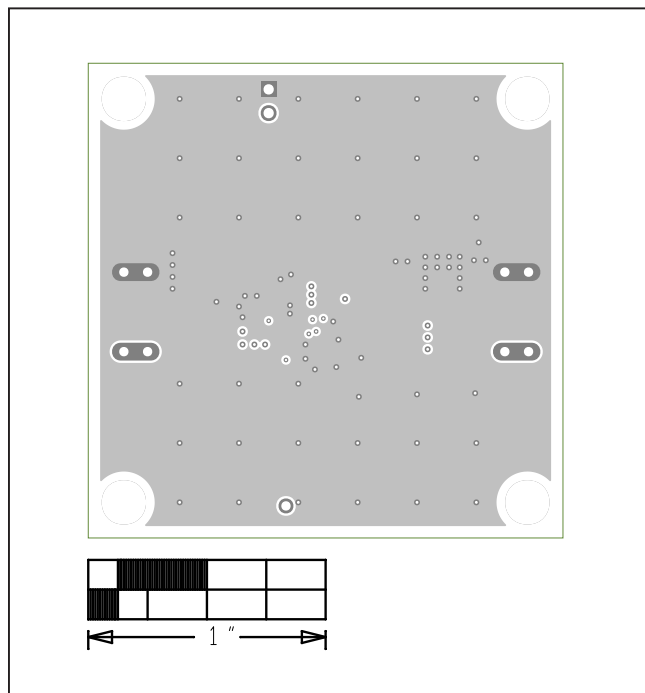## MAXM17552 EV Kit Schematic
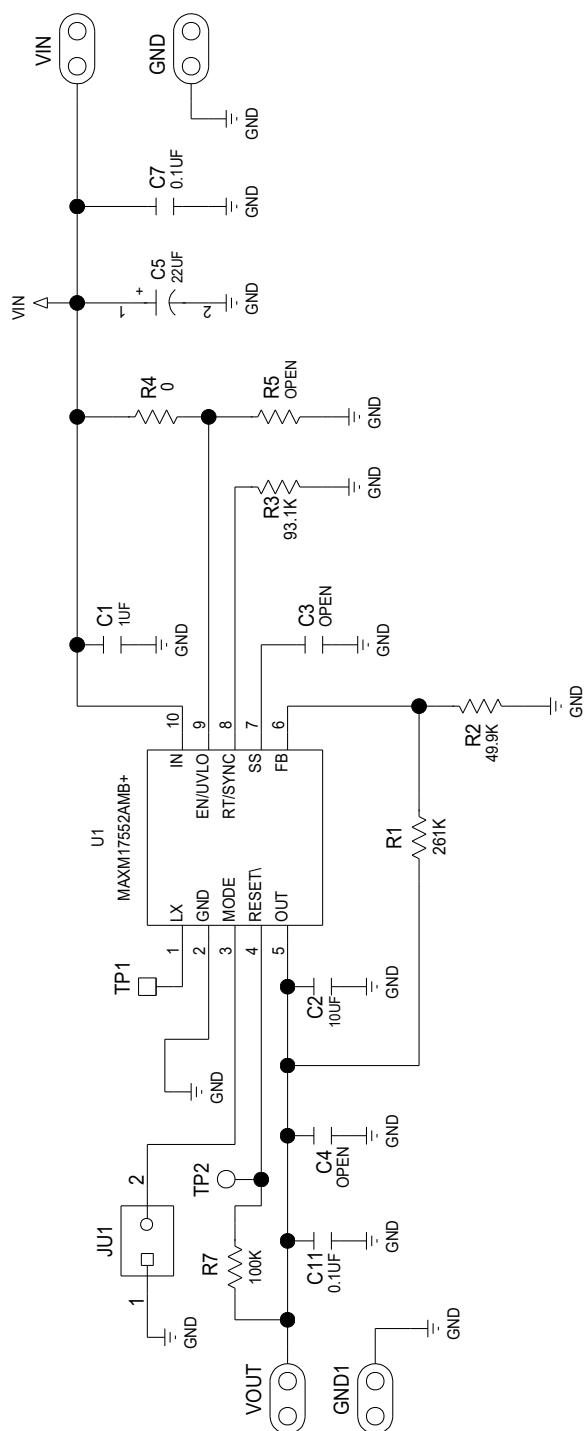
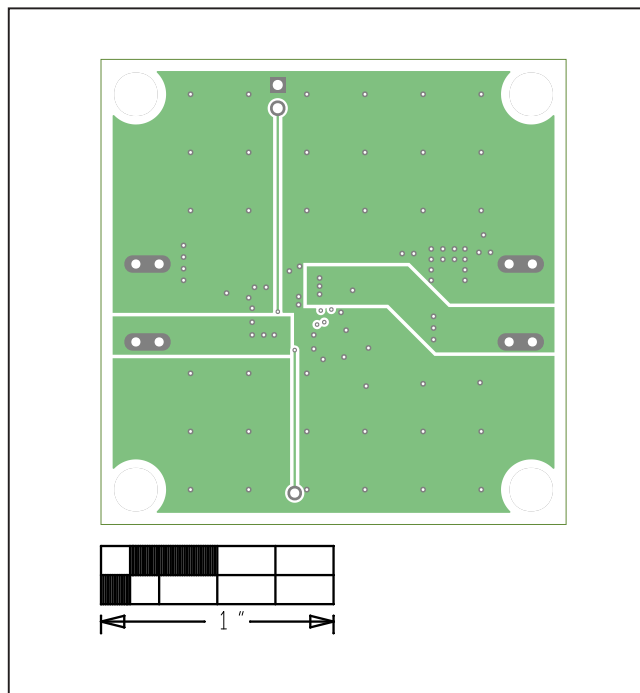## MAXM17552 EV Kit PCB Layouts
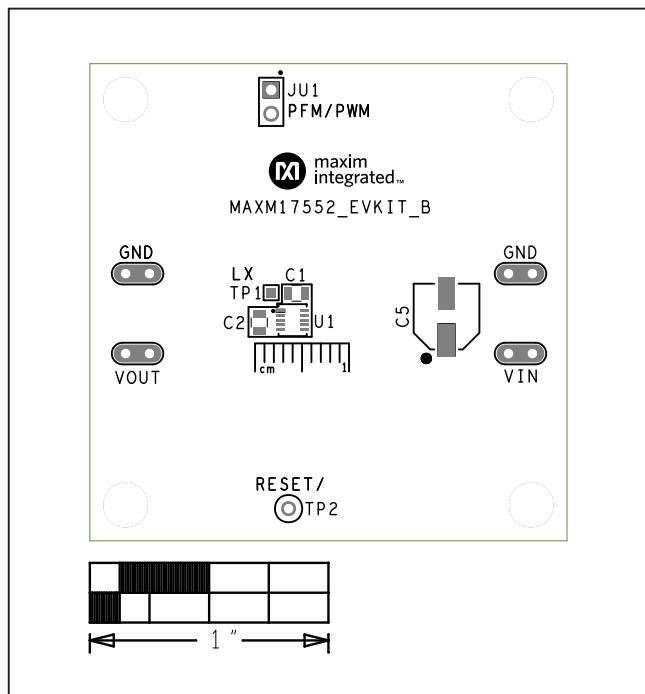
MAXM17552 EV Kit PCB Layout—Top Silkscreen

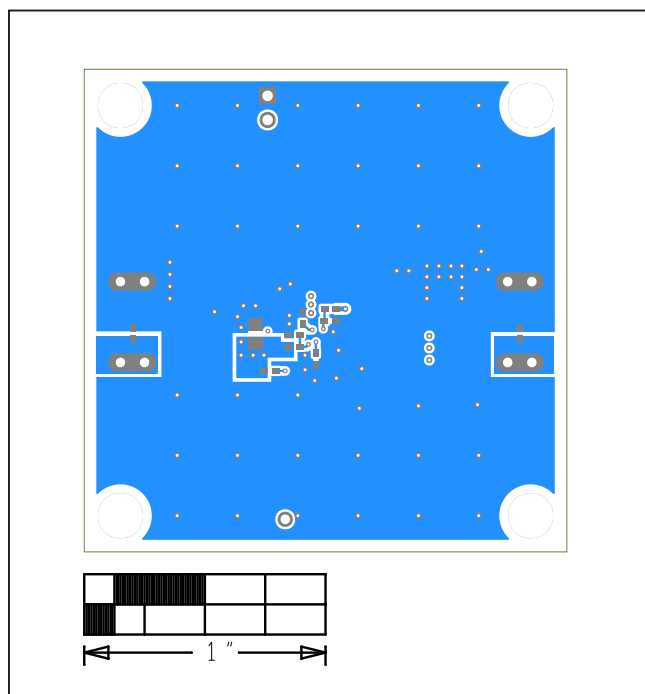*MAXM17552 EV Kit PCB Layout—Top Layer*

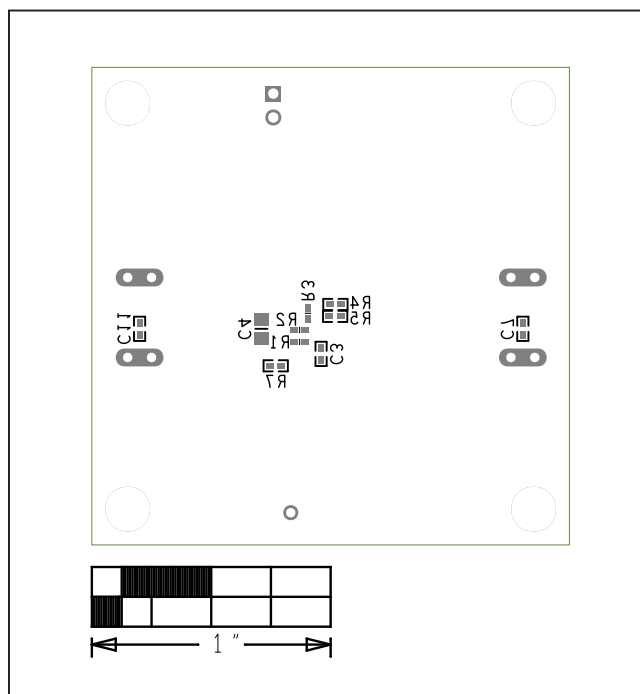*MAXM17552 EV Kit PCB Layout—GND Layer*

MAXM17552 EV Kit PCB Layout—Inner Layer

MAXM17552 EV Kit PCB Layouts (continued)

MAXM17552 EV Kit PCB Layout—Bottom Layer

MAXM17552 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/17	Initial release	—
1	10/18	Updated the *General Description, Features, Quick Start, Detailed Description,* and *Reset Outpu (RESET)* sections; added the Mode Selection (MODE) section and Table 1; replaced *EV Kit Performance Report* charts, *Bill of Materials, Schematic,* and *PCB Layout*.	1–8
1.1		Corrected missing overbar	1