MAX20098 Evaluation Kit

Evaluates: MAX20098

General Description

The MAX20098 evaluation kit (EV kit) provides a proven design to evaluate the MAX20098 automotive 2.2MHz synchronous step-down controller with 3.5µA I_Q. The EV kit PCB comes with a MAX20098ATEA/VY+ installed, as well as various test points and jumpers for evaluation. The EV kit output voltage is fixed and is easily configured with minimum component changes. The EV kit is designed to deliver up to 7A with input voltages from 3.5V to 36V and by switching at 400kHz/2.2MHz, but can be configured to deliver up to 20A. Output-voltage quality can be monitored by observing the PGOOD signal.

Benefits and Features

- 3.5V to 36V Input Supply Range
- Output Voltage: 5V or 3.3V Fixed, or Adjustable from 1V up to 10V
- Delivers up to 20A Output Current
- Frequency-Synchronization Input
- Enable Input
- Voltage-Monitoring PGOOD Output
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

- MAX20098 EV kit
- 3.5V to 36V, 7A power supply (capable of providing 7A at 3.5V input)
- Digital multimeter (DMM)
- Oscilloscope
- Electronic load capable of sinking 7A

Procedure

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

1) Verify that all jumpers are in their default positions, as shown in Table 1.
2) Connect the positive and negative terminals of the power supply to the SUP and GND1 test pads, respectively.
3) Set the power-supply voltage to 14V and current limit to 3A.
4) Turn on the power supply.
5) Verify that OUT is approximately 5V using the DMM.
6) Verify that the switching frequency is approximately 2.2MHz by monitoring inductor switching voltage with the oscilloscope.

Additional Evaluation

7) Connect the positive and negative terminals of the electronic load to OUT and GND, respectively.
8) Set the electronic load to the desired current at or below 7A, or use an equivalent resistive load with an appropriate power rating.
9) Adjust current limit on the power supply as necessary.
10) Turn on the power supply and electronic load.
11) Verify that voltage across the VOUT and GND PCB pads is 5V ±1%.

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Table 1. Default Jumper Settings

JUMPER	DEFAULT SHUNT POSITION	FUNCTIONS
ENABLE	1-2	Buck enabled
SYNC	1-2	Forced-PWM mode

Detailed Description of Hardware

The MAX20098 EV kit provides a proven layout for the MAX20098 synchronous buck regulator IC. The IC accepts input voltages as high as 36V and delivers up to 20A. The EV kit can handle an input supply transient up to 42V. Various test points are included for evaluation.

External Synchronization

The IC can operate in two modes: forced-PWM (FPWM) or skip mode. Skip mode has better efficiency for light-load conditions. When SYNC is pulled low, the IC operates in skip mode for light loads and PWM mode for larger loads. When SYNC is pulled high, the IC is forced to operate in PWM mode across all load conditions. SYNC can be used to synchronize with other supplies if a clock source is present. The IC is forced to operate in FPWM mode when SYNC is connected to a clock source.

Buck Output Monitoring (PGOOD)

The EV kit provides a power-good output test point (PGOOD) to monitor the status of the buck output (OUT). PGOOD is low impedance when the output voltage is in regulation. PGOOD is high impedance when the output voltage drops below 7% (typ) of its nominal regulated voltage.

BST Diode

The BST diode (D1) can be removed if operating in skip mode or at low switching frequency, 400kHz. Skip mode is set with a shunt position of 2-3 on the SYNC jumper.

Evaluating the MAX20098

The IC is available in fixed 5V and 3.3V outputs. The EV kit comes installed with the 5V output version. To externally configure the output voltage, remove R1 and place appropriate resistors in positions R17 and R19. To optimize efficiency, refer to the MAX20098 IC data sheet.

Evaluate 400kHz or 2.2MHz Operation

Order the MAX20098EVKIT# to evaluate 2.2MHz operation. Order the MAX20098LFEVKIT# to evaluate 400kHz operation. Table 2 lists different component selections for both 2.2MHz and 400kHz switching frequencies (the other components remain the same).

Ordering Information

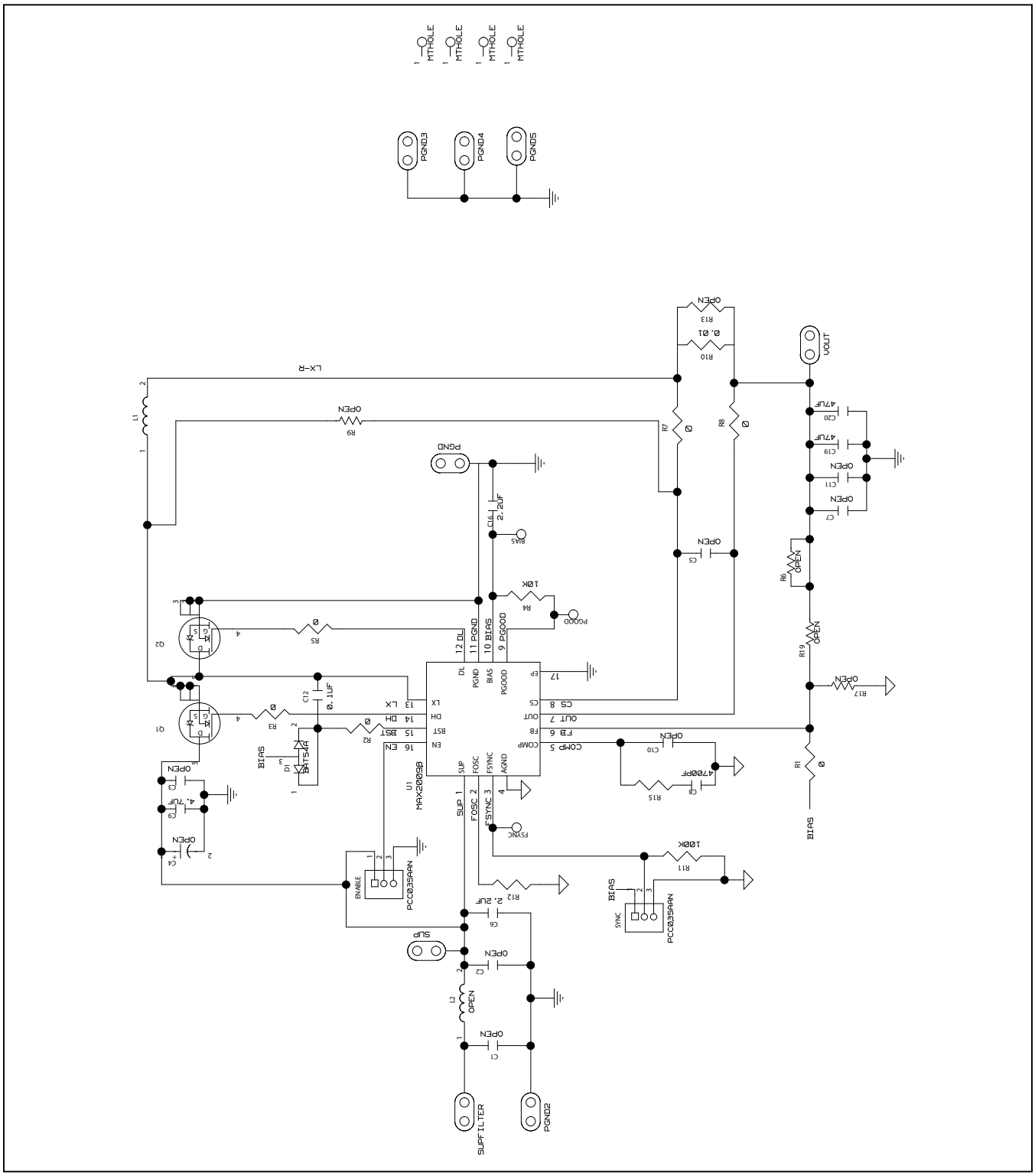
PART	TYPE	f_{SW}
MAX20098EVKIT#	EV Kit	2.2MHz
MAX20098LFEVKIT#	EV Kit	400kHz

#Denotes RoHS compliant.

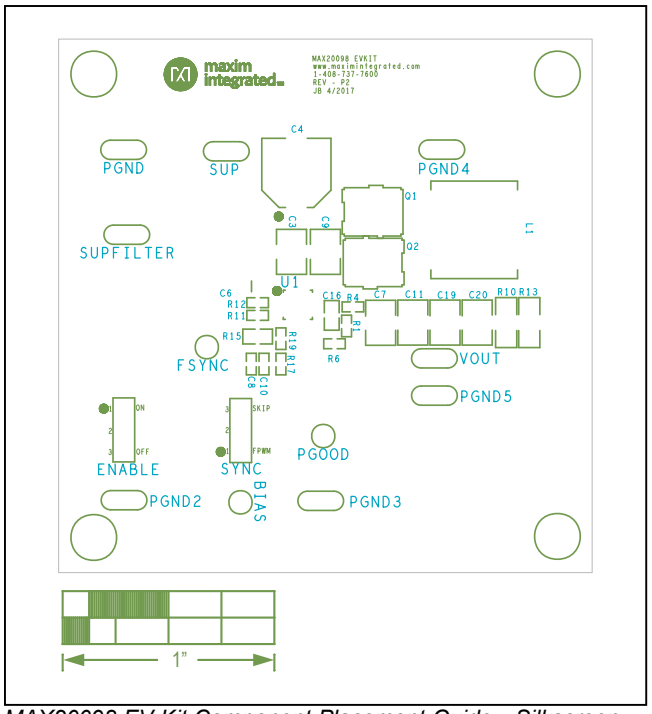
MAX20098 EV Kit Bill of Materials

REFERENCE DESIGNATOR	QTY	DESCRIPTION	MFG PART #
COMPONENT LIST: $5V_{OUT}$, 2.2MHz SWITCHING FREQUENCY, UP TO 7A LOAD			
C6	1	2.2µF±20% 50V Ceramic Capacitor (0805)	CGA4J3X7R1H225M125AE
C8	1	4700PF±5% 50V Ceramic Capacitor (0402)	CL05B472JB5NNNC
C9	1	4.7µF ±10% 50V X7R Ceramic Capacitor (1210)	GRM32ER71H475KA88K
C12	1	0.1µF ±10% 50V Ceramic Capacitor (0402)	GRM155R71H104KE14
C16	1	2.2µF±10% 10V Ceramic Capacitor (0603)	CL10B225KP8NNN
C19	1	47µF ±10% 16V X6S Ceramic Capacitor (1210)	GRM32ER71A476KE15L
C20	1	47µF ±10% 16V X6S Ceramic Capacitor (1210)	GRM32ER71A476KE15L
D1	1	Diode; SCH; Schottky Diode; SMT (SOT23-3); PIV = 30; IF = 0.2A	BAT54A
L1	1	1.2µH Inductor	XAL1060-122MEB
Q1, Q2	2	N-Channel 40V Surface Mount 5-DFN, 8-SO Flat Lead (5x6)	NVMFS5C468NLT1G
R1, R2, R5, R7, R8	6	0Ω resistor (0402)	CRCW04020000Z0EDHP
R3	1	2.5Ω resisitor (0402)	—
R4	1	10kΩ resistor (0402)	RC0402FR-0710K
R10	1	0.01Ω resistor (1206)	PMR18EZPFU10L0
R11	1	100kΩ resistor (0402)	TNPW0402100KBE
R12	1	12kΩ resistor (0402)	ERJ-2RKF1202
R15	1	51.1kΩ resistor (0603)	ERJ-3EKF5112V
U1	1	MAX20098ATEA/VY+	—
—	1	PCB: MAX20098 EVKIT	—
COMPONENT CHANGES FOR 400kHz SWITCHING FREQUENCY			
D1	DNI	Diode; SCH; Schottky Diode; SMT (SOT23-3)	BAT54A
L1	1	4.7µH Inductor	XAL1060-472MEB
R3	1	0Ω resistor (0402)	—
R12	1	66.5kΩ resistor (0402)	ERJ-2RKF6652X
R15	1	30.1kΩ resistor (0603)	PTN0603E3012BST1
Note: R10 can be adjusted to change the output current limit.			

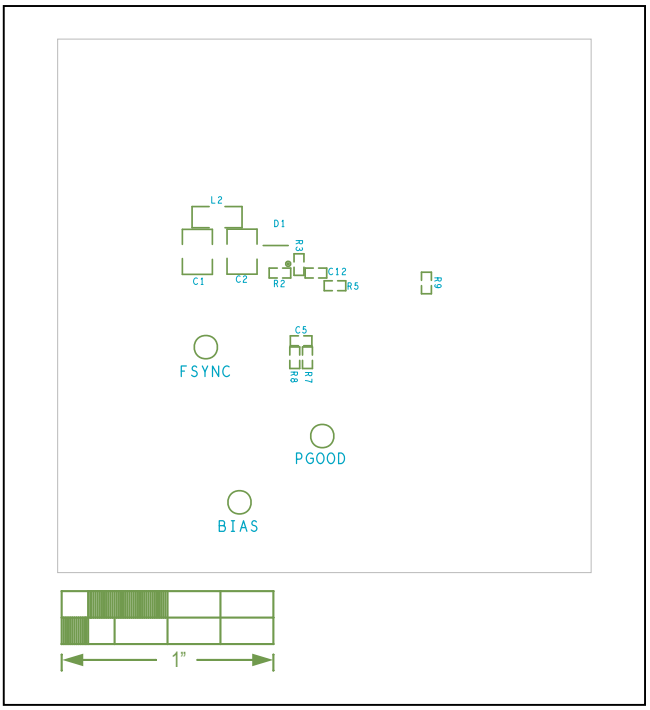
MAX20098 EV Kit Schematic



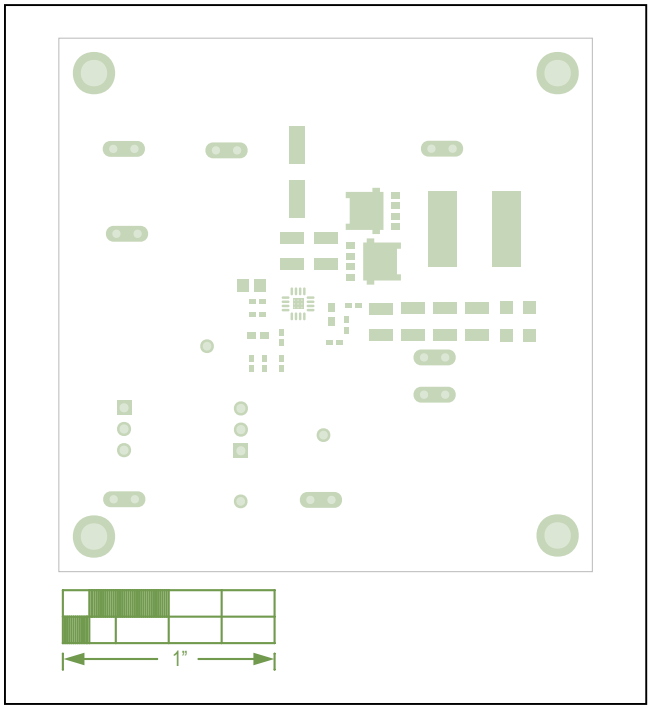
MAX20098 EV Kit PCB Layouts



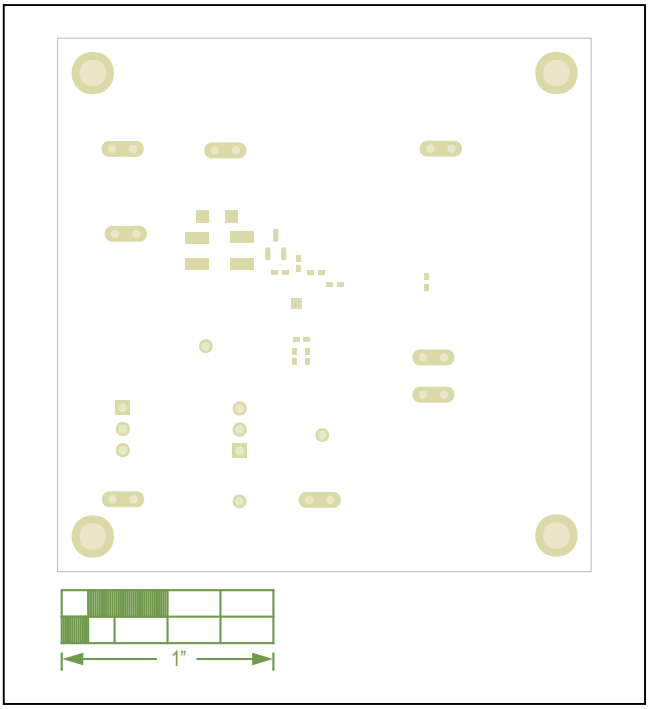
MAX20098 EV Kit Component Placement Guide—Silkscreen (Top)



MAX20098 EV Kit Component Placement Guide—Silkscreen (Bottom)

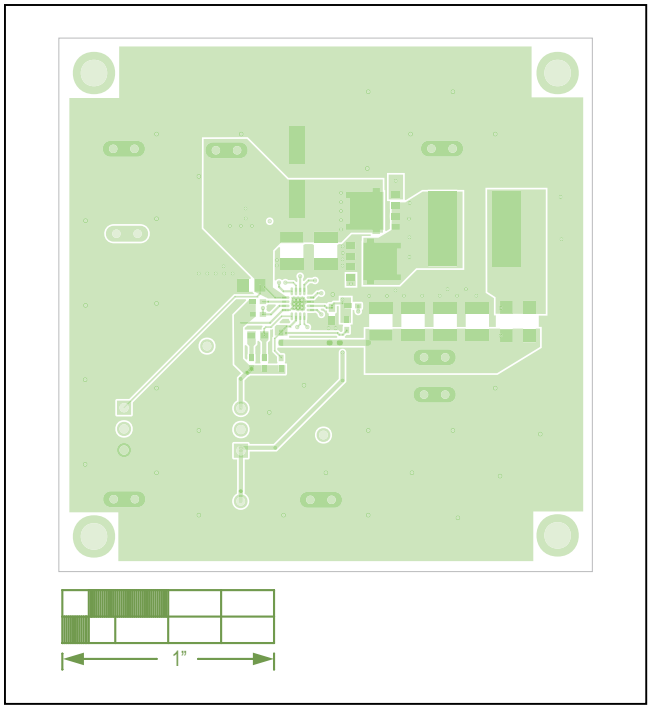


MAX20098 EV Kit PCB Layout—Soldermask (Top)

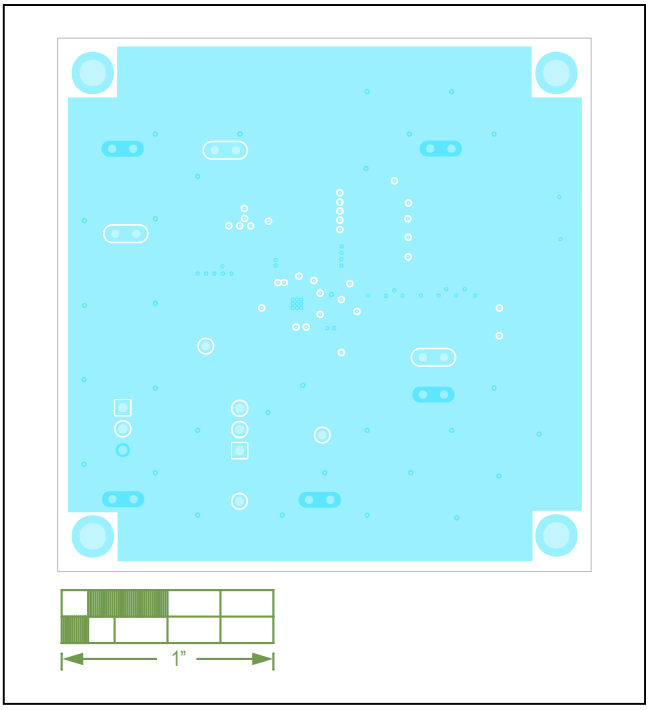


MAX20098 EV Kit PCB Layout—Soldermask (Bottom)

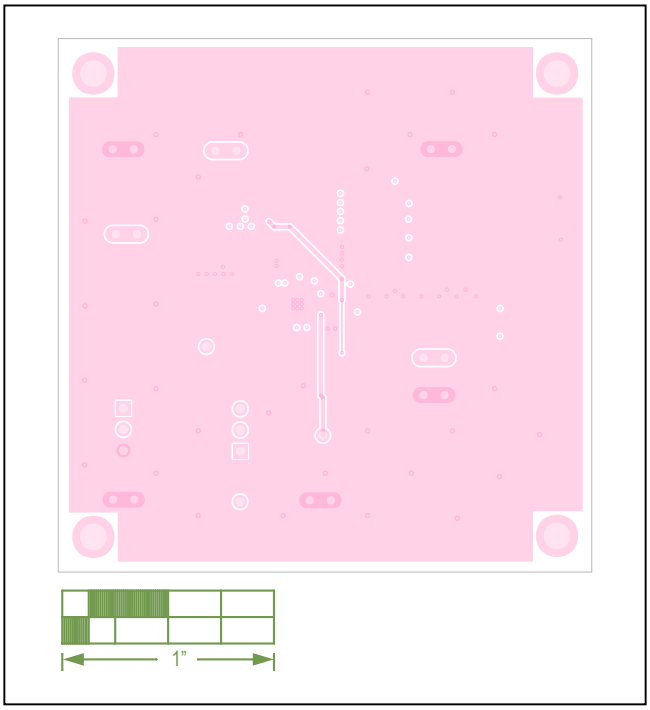
MAX20098 EV Kit PCB Layouts (continued)



MAX20098 EV Kit PCB Layout—Art Film (Top)

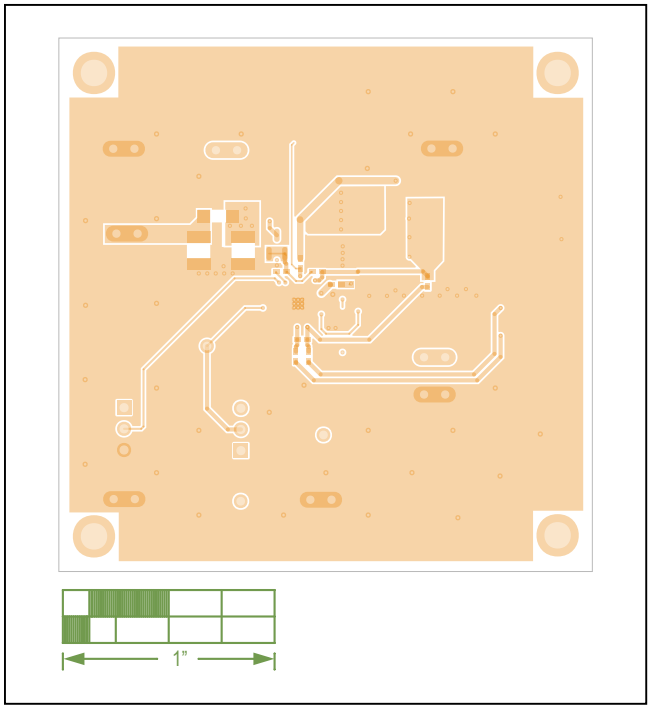


MAX20098 EV Kit PCB Layout—Internal (Layer 2)

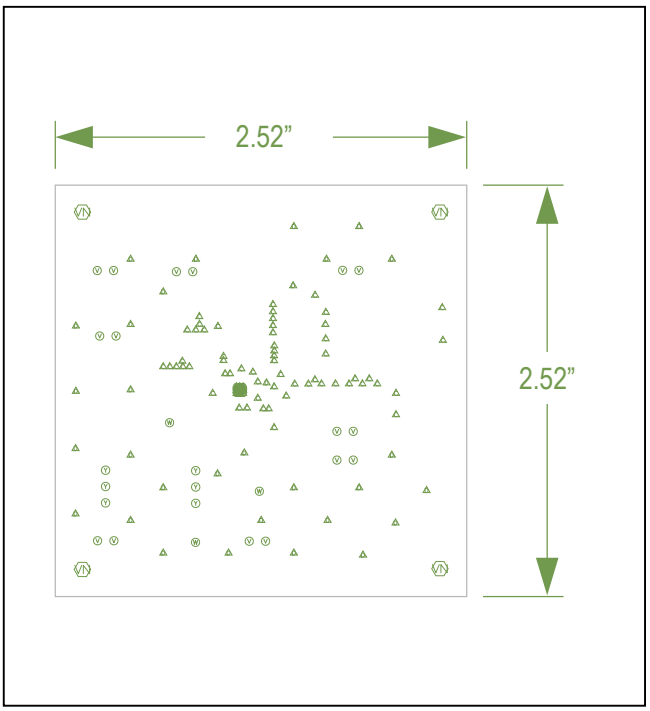


MAX20098 EV Kit PCB Layout—Internal (Layer 3)

MAX20098 EV Kit PCB Layouts (continued)



MAX20098 EV Kit PCB Layout—Art Film (Bottom)



MAX20098 EV Kit PCB Layout—Art Film (Fab Drawing)

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/17	Initial release	—
1	2/18	Updated *Bill of Materials*	3
2	10/18	Updated *General Description*, added *BST Diode* section, added *Evaluate 400kHz or 2.2.MHz Operation*, updated *Ordering Information*, and *MAX20098 EV Kit Bill of Materials*	1–3
3	11/18	Updated *Bill of Materials*	3
4	4/19	Updated *Bill of Materials*	3

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