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MAX20474 Evaluation Kit

Evaluates: MAX20474 Adjustable and Non-Adjustable Options

General Description

The MAX20474 evaluation kit (EV kit) evaluates the performance of the MAX20474 synchronous boost converter.

The MAX20474 is a high-efficiency DC-DC converter which boosts a 3.0V to 5.5V input supply from 6V to 18V at up to 1A load. The boost converter achieves ±1.5% output error over load, line, and temperature range.

The device features a 2.2MHz fixed-frequency PWM mode for better noise immunity and load transient response and a pulse-frequency modulation mode (SKIP) for increased efficiency during light load operation. The 2.2MHz frequency operation allows for the use of all ceramic capacitors and minimizes external components. The programmable spread-spectrum frequency modulation minimizes radiated electromagnetic emissions. Integrated low R_{DSON} switches improve efficiency at heavy loads and simplifies the layout with respect to discrete solutions.

Other features include true shutdown, soft-start, and overcurrent and overtemperature protections.

Features

- Synchronous Boost Converter for Small Solution Size
  - 4A Peak Input Current
  - Resistor Adjustable Output Voltage form 6V to 18V
  - 6V to 18V Fixed Output Selection in 250mV Steps
  - 3.0V to 5.5V Operating Supply Voltage
  - 2.2MHz Switching Frequency Operation
  - $\overline{\text{RESET}}$ Output
  - Spread Spectrum Operation
- High Precision Performance
  - ±1.5% Output Voltage Accuracy Fixed Option
  - ±2.2% Output Voltage Accuracy Adjustable Option
  - 81 ±3% UV Monitoring
  - 121 ±3% OV Monitoring
  - Good Load Transient Performance
- Robust for the Automotive Environment
  - Current Mode Control, Forced PWM and SKIP Operation
  - Overtemperature and Short-Circuit Protection
  - Space Saving 3mm x 3.5mm 14-Pin TDFN Package

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

Quick Start

Required Equipment

- Bench power supply capable of sourcing 5A minimum
- Electronic or resistive load
- High-bandwidth oscilloscope for analyzing waveforms (500MHz bandwidth suggested)
- Voltmeters (DMM) to measure test points

Procedure

The MAX20474 EV kit is delivered fully assembled and tested. The MAX20474EVKIT# is populated with the MAX20474ATDA/V+ output voltage adjustable option. The MAX20474EVKIT# also supports the MAX20474 fixed output voltage option with minimal changes to external components. For other adjustable V_{OUT} configurations, refer to the IC data sheet and Component Calculator for guidance on selecting the proper external components.

1) Ensure all jumpers are in their default positions. See Table 1 for default jumper configuration settings.
2) Connect the positive terminal of the PSU to the VIN_PLUG of the EV kit.
3) Connect the negative terminal from the PSU to the PGND6 plug of the EV kit.
4) Connect a DMM to VIN_TP on the EV kit to measure the input voltage.
5) Connect a second DMM to VOUT_TP of the EV kit to measure the output voltage.
6) Connect CH1 of an oscilloscope to LX_TP of the EV kit to measure the switch node voltage waveform.
7) Set the positive output of the PSU to 5V with a current limit of 5A, then apply power to the EV kit.
8) Verify that the voltage measured at VIN_TP is 5V and the voltage measured at VOUT_TP is approximately 12V.
9) Connect an electronic load to the VOUT_PLUG of the EV kit and set it for 1A, then turn on the electronic load.
10) Verify that the voltage measured at VOUT_TP of the EV kit is within ± 1.5% of the unloaded output voltage from step 8.
11) Congratulations! Verification of the MAX20474 EV kit is complete.
12) Repeat steps 1-11 when exchanging devices to ensure a proper soldering connection.

319-100792; Rev 0; 7/21

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Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	FUNCTION
J1–ENABLE	1–2	Enable boost controller
J2–MODE	1–2	Default FPWM operation
J3–SPREAD SPECTRUM	2–3	Default spread spectrum disabled

Table 2. Test Points

TEST POINT	FUNCTION
VIN_TP	Test point for the input voltage
LX_TP	Test point for the switch node voltage
VOUT_TP	Test point for the output voltage
SIG_INJP	Test point for positive transformer signal injection
SIG_INJN	Test point for negative transformer signal injection

Table 3. Test Loops

TEST LOOP	FUNCTION
VIN_AV	Test loop for V_{IN} and AV (shorted together)
V_{OUT}	Test loop for the output voltage
SYNC	Test loop for the external clock
EN	Test loop for the enable pin
BIAS	Test loop for the bias pin
$\overline{RESET}$	Test loop for the $\overline{RESET}$ pin
PGND (1-4)	Test loops for power ground

Detailed Description

The MAX20474 EV kit allows for typical evaluation of device performance with a fixed output voltage or an adjustable output voltage. See the *Adjustable Output Voltage* section in this document for more details. With the installation of R2, it is also possible to evaluate the closed loop stability performance if a network analyzer is available. Contact the factory for guidance on connecting measuring a network analyzer to measure closed loop performance.

Synchronization (SYNC)

The SYNC pin provides three separate features depending on the connection. When the SYNC jumper (J2) is tied to AV (position 1-2), the MAX20474 operates in FPWM mode. If SYNC is tied to ground (position 2-3) or left open, the MAX20474 operates in SKIP mode to provide higher efficiency with light load conditions. SYNC can be directly driven from an external source to synchronize the switching frequency other than the factory trimmed 2.2MHz. To change the switching frequency of the MAX20474, connect an external clock source to the SYNC test loop. When the MAX20474 is driven from an external source, the MAX20474 always operates in FPWM mode. Refer to the IC data sheet for the correct frequency range supported by the SYNC pin.

Enable Input (EN1)

The ENABLE pin is an active high input. However, by connecting ENABLE to ground, the output of the MAX20474 stops switching and the output is pulled to ground through an internal pulldown resistor. Jumper J1 enables and disables the MAX20474. When J1 is in position 1-2, the MAX20474 is enabled. If J1 is in position 2-3 or left open, the MAX20474 is disabled.

Spread Spectrum Enable Input (SSEN)

When tied high, the SSEN pin enables spread spectrum functionality to help mitigate EMI. When the SSEN jumper (J3) is connected to VIN_AV (position 1-2), the MAX20474 operates with spread spectrum enabled. To disable spread spectrum, connect the SSEN jumper to position 2-3 in order to connect the SSEN pin to ground.

$\overline{RESET}$ Output

The $\overline{RESET}$ output is an open-drain output connection that requires a pullup resistor. The hold times for $\overline{RESET}$ are factory OTP programmed from a range of 0.5ms to 14.8ms. $\overline{RESET}$ can be asserted when the output voltage is outside of the OV/UV window. Refer to the product data sheet for expected OV/UV levels relative to the output voltage.

Adjustable Output Voltage

The MAX20474 EV kit can be accommodated to evaluate a MAX20474 adjustable output voltage option. Refer to the *Ordering Information* table in the product data sheet to ensure that the desired MAX20474 device supports adjustable output voltages.

For a given output voltage, the correct value of external components must be installed for the external feedback network on the MAX20474 EV Kit: R3, R4, and C1. These feedback network values are determined by several criteria. Refer to the MAX20474 product data sheet for the correct calculation procedure.

Ordering Information

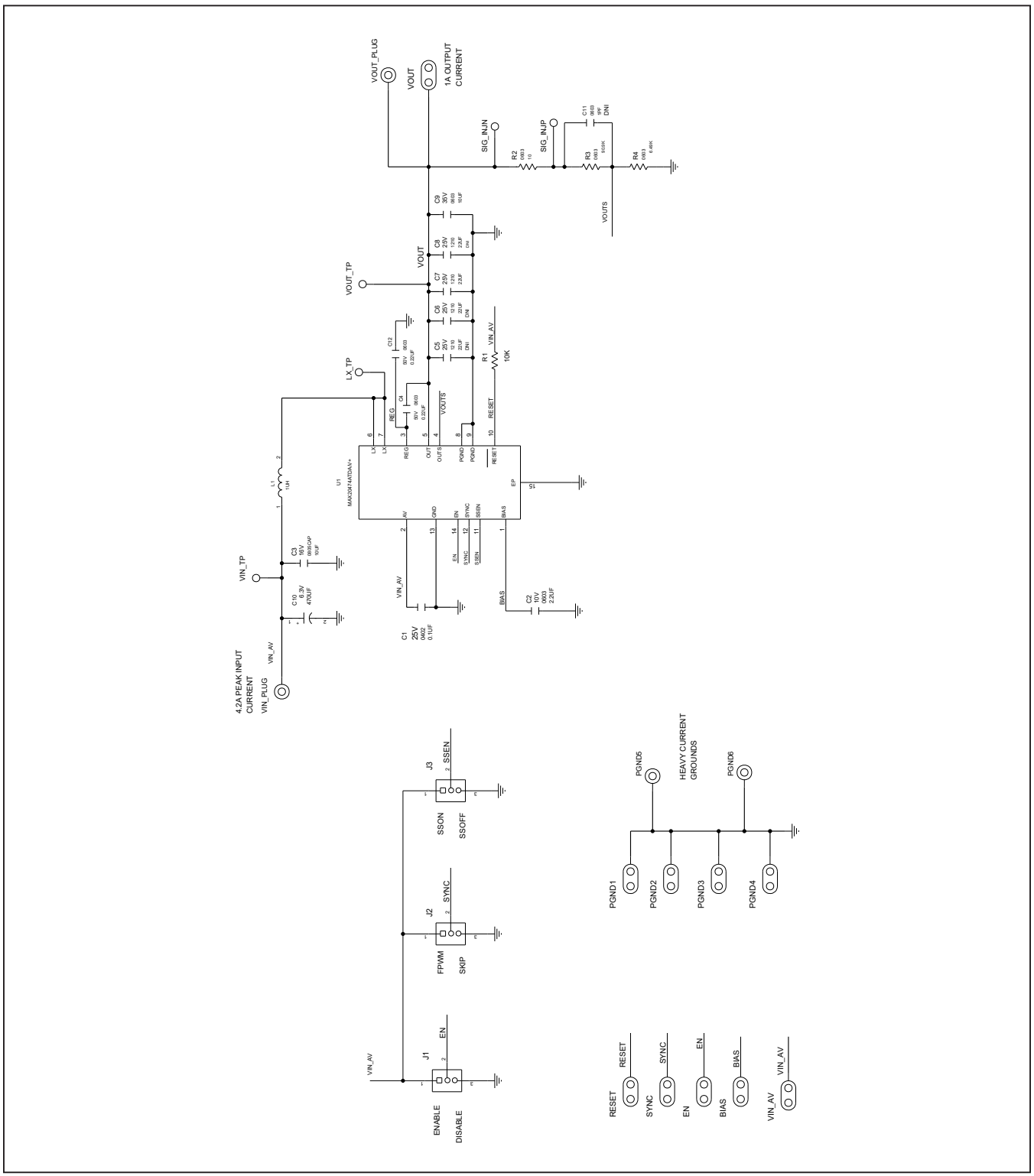
PART	TYPE
MAX20474EVKIT#	EV KIT

#Denotes a RoHS-compliant device that may include lead(Pb) that is exempt under the RoHS requirements.

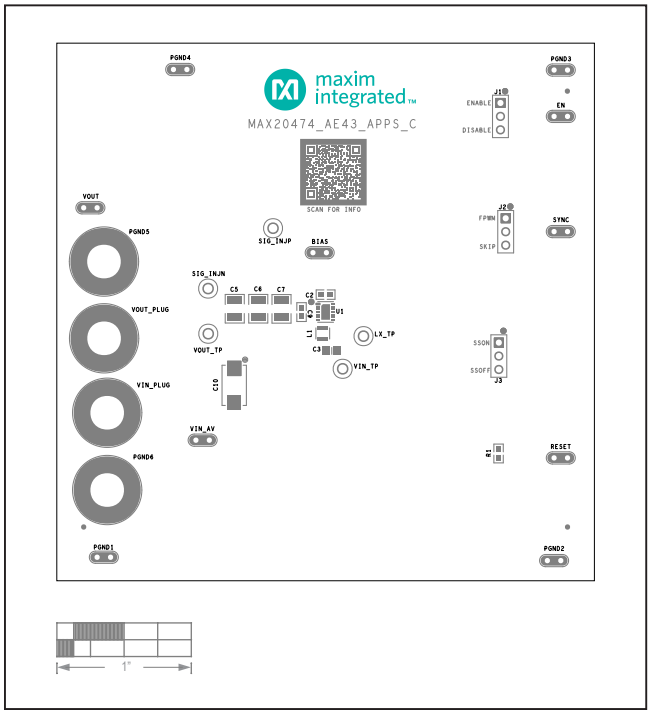
MAX20474 EV Kit Bill of Materials

QTY	REF_DES	DNI/DNP	VALUE	MFG PART #	MANUFACTURER	DESCRIPTION
1	U1	-	MAX20474ATDA/V+	MAX20474ATDA/V+	MAXIM	SYNCHRONOUS BOOST CONVERTER;
10	BIAS, EN, PGND1-PGND4, RESET, SYNC, VIN_AV, VOUT	-	MAXIMPAD	9020 BUSS	WEICO WIRE	WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG
1	C1	-	0.1UF	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA; TDK; TAIYO YUDEN; TDK	CAP; SMT (0402); 0.1UF; 10%; 25V; X7R; CERAMIC
1	C2	-	2.2UF	GRM188R71A225KE15; CL10B225KP8NNN; C1608X7R1A225K080AC; C0603C225K8RAC	MURATA; SAMSUNG; TDK; KEMET	CAP; SMT (0603); 2.2UF; 10%; 10V; X7R; CERAMIC
1	C3	-	10UF	CGA4J1X7S1C106K125; GCM21BC71C106KE35	TDK; MURATA	CAP; SMT (0805); 10UF; 10%; 16V; X7S; CERAMIC
2	C4, C12	-	0.22UF	CGA3E3X7R1H224K080AB	TDK	CAP; SMT (0603); 0.22UF; 10%; 50V; X7R; CERAMIC
1	C7	-	22UF	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM; C1210C226K3RAC7210	MURATA; SAMSUNG; SAMSUNG; TAIYO YUDEN; KEMET	CAP; SMT (1210); 22UF; 10%; 25V; X7R; CERAMIC
1	C9	-	10UF	GRM188R6YA106MA73	MURATA	CAP; SMT (0603); 10UF; 20%; 35V; X5R; CERAMIC
1	C10	-	470UF	T530X477M006ATE004; 6THB470M	KEMET; PANASONIC	CAP; SMT (7343-43); 470UF; 20%; 6.3V; POLYMER
3	J1-J3	-	PEC03SAAN	PEC03SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS
1	L1	-	1UH	TFM252012ALMA1R0MTAA	TDK	INDUCTOR; SMT; THIN FILM; 1UH; 20%; 4.1A
3	LX_TP, VIN_TP, VOUT_TP	-	N/A	5005	KEYSTONE	TEST POINT;BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
4	PGND5, PGND6, VIN_PLUG, VOUT_PLUG	-	108-0740-001	108-0740-001	EMERSON NETWORK POWER	CONNECTOR; MALE; PANELMOUNT; BANANA JACK; STRAIGHT; 1PIN
1	R1	-	10K	CRCW060310K0JN;ERJ-3GEYJ103	VISHAY DALE; PANASONIC	RES; SMT (0603); 10K; 5%; +/-200PPM/DEGK; 0.1000W
1	R2	-	10	CRCW060310R0FK; MCR03EZPFX10R0; ERJ-3EKF10R0	VISHAY DALE; ROHM	RES; SMT (0603); 10; 1%; +/-100PPM/DEGC; 0.1000W
1	R3	-	90.9K	ERJ-3EKF9092	PANASONIC	RES; SMT (0603); 90.9K; 1%; +/-100PPM/DEGC; 0.1000W
1	R4	-	6.49K	CRCW06036K49FK; ERJ-3EKF6491	VISHAY DALE; PANASONIC	RES; SMT (0603); 6.49K; 1%; +/-100PPM/DEGC; 0.1000W
2	SIG_INJN, SIG_INJP	-	N/A	5007	KEYSTONE	TEST POINT; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
0	C5, C6, C8	DNP	22UF	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM; C1210C226K3RAC7210	MURATA; SAMSUNG; SAMSUNG; TAIYO YUDEN; KEMET	CAP; SMT (1210); 22UF; 10%; 25V; X7R; CERAMIC
0	C11	DNP	1PF	CL10C010BBNC; C1608C0G1H010B	SAMSUNG ELECTRONICS; TDK	CAP; SMT (0603); 1PF; 50V; C0G; CERAMIC

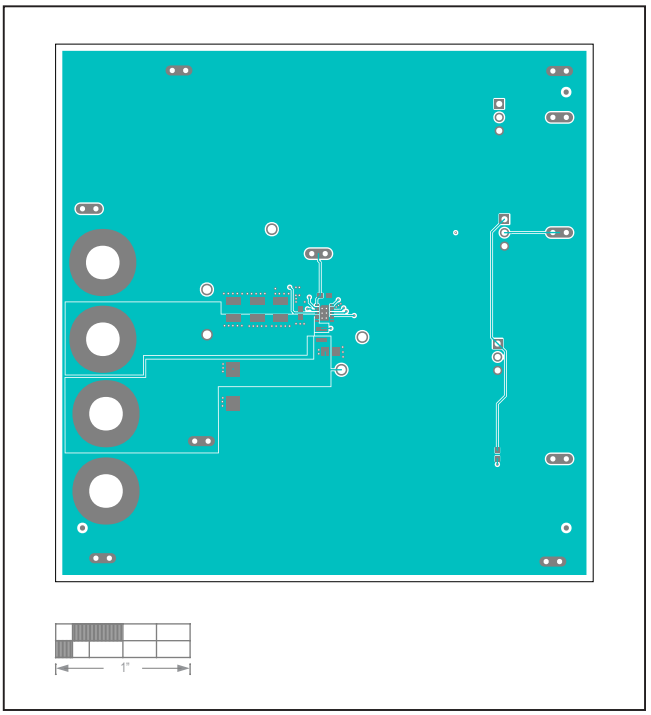
MAX20474 EV Kit Schematic



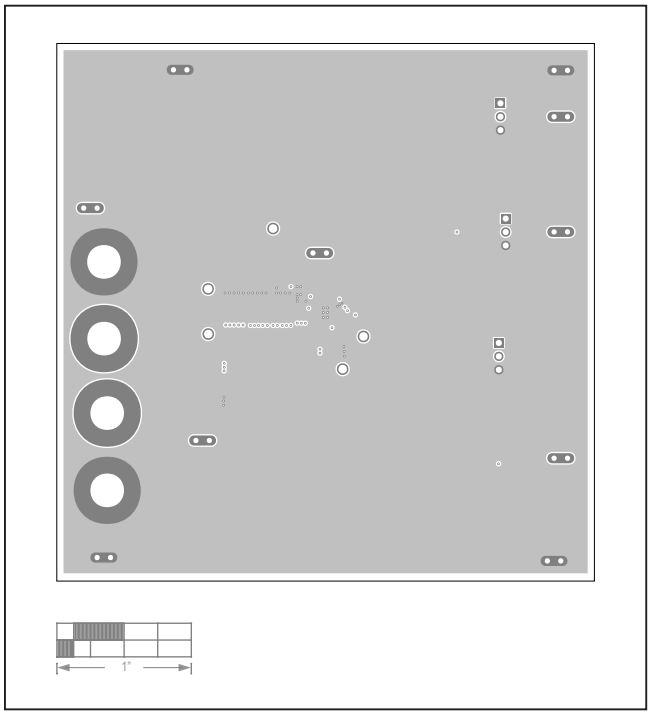
MAX20474 EV Kit PCB Layout



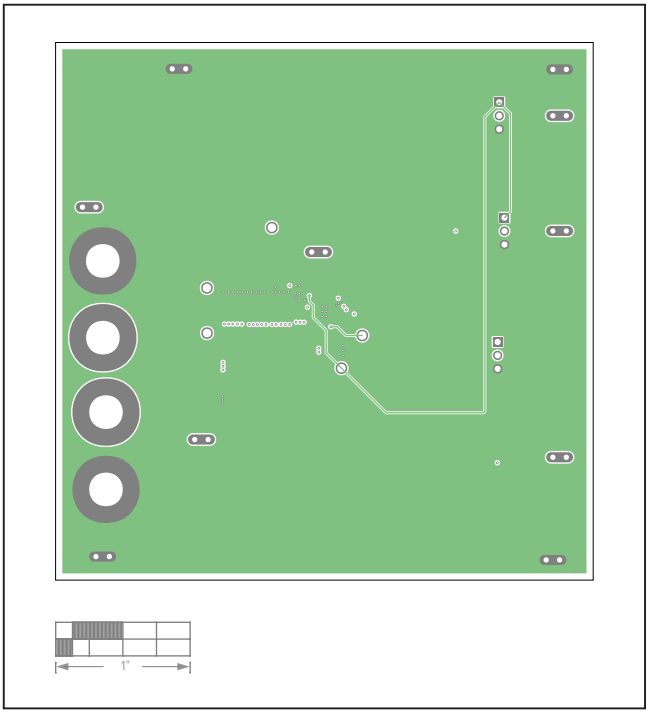
MAX20474 EV Kit PCB Layout—Top Silkscreen



MAX20474 EV Kit PCB Layout—Top Layer

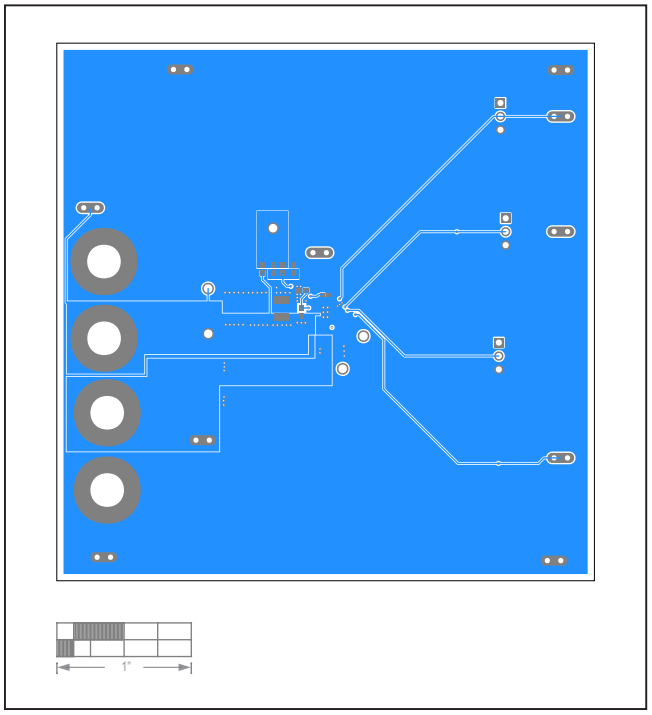


MAX20474 EV Kit PCB Layout—Layer 2

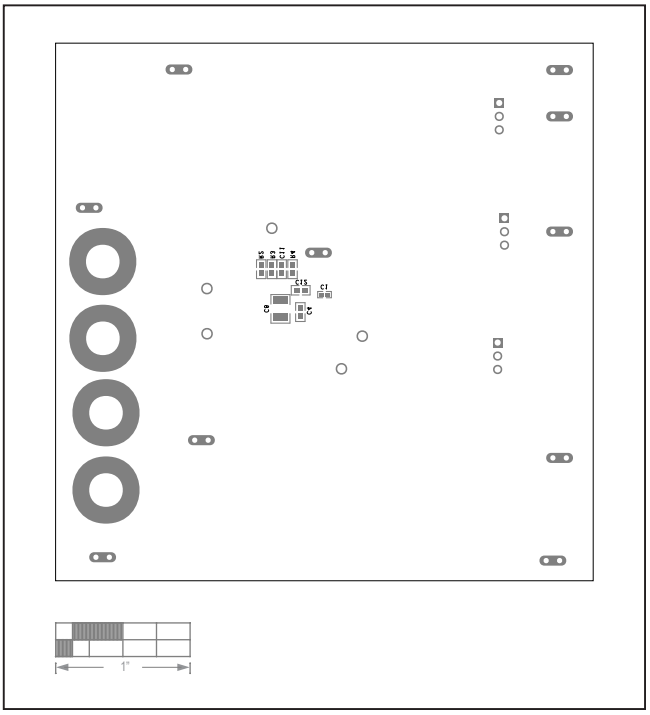


MAX20474 EV Kit PCB Layout—Layer 3

MAX20474 EV Kit PCB Layout (continued)



MAX20474 EV Kit PCB Layout—Bottom Layer



MAX20474 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/21	Release for Market Intro	—

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