MAX20057 Evaluation Kit

Evaluates: MAX20057

General Description

The MAX20057 evaluation kit (EV kit) is a fully assembled and tested application circuit that simplifies the evaluation of the MAX20057 400kHz/2.1MHz, 36V boost controller and dual buck converters. All installed components are rated for the automotive temperature range. Various test points and jumpers are included for evaluation.

The standard EV kit comes with the MAX20057ATIE/VY+ installed (5V, 3.3V, 2.1MHz), but can also be used to evaluate other MAX20057 variants with minimal component changes shown in the *MAX20057 EV Kit Bill of Materials*.

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

Features

- Dual High-Voltage Step-Down Converters with Integrated Power FETs to Minimize Board-Area-Occupancy
- Asynchronous Boost Controller
- 3.5V to 40V Input Supply Range
- Input Supply Range Extended Down to 2V with Boost Preenabled
- 10V Fixed Boost Output Voltage
- Buck1 Provides 5V Output Up To 3.5A Output Current
- Buck2 Provides 3.3V Output Up To 2A Output Current
- Buck Output Voltages Adjustable Between 1V and 10V Using External Resistors
- ±2% Output Voltage Accuracy for Buck Converters
- Selectable Buck2 Input Source
- Frequency-Synchronization Input
- Independent Enable Inputs
- Voltage-Monitoring PGOOD Outputs
- Jumpers and Test Points on Key Nodes for Simplified Evaluation
- Proven PCB Layout
- Fully Assembled and Tested

Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	FUNCTION
JU3_EN1	1-2	Buck1 controller enabled
JU2_EN2	1-2	Buck2 controller enabled
JU1_EN3	1-2	Boost controller enabled
JU2_SUPSW2	2-3	Buck2 input supplied by Boost output voltage
JU4_FSYNC	1-2	FSYNC is pulled to V_{BIAS} enabling FPWM mode
JU_PGOOD1	Installed	PGOOD1 is pulled up to V_{BIAS} when OUT1 is in regulation
JU_PGOOD2	Installed	PGOOD2 is pulled up to V_{BIAS} when OUT2 is in regulation
JU5_EXTVCC	1-4	EXTVCC is connected to GND

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Quick Start

Required Equipment

- MAX20057 EV kit
- Adjustable DC power supply (PS1)
- Two digital multimeters (DMM1 and DMM2)
- Two electronic loads (EL1 and EL2)

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. Disable power supply output.
2) Connect the positive and negative terminals of PS1 to the VBATTF and GND test pads, respectively.
3) Connect the positive terminal of DMM1 to VOUT1; connect the negative terminal of DMM1 to PGND1.
4) Connect the positive terminal of DMM2 to VOUT2; connect the negative terminal of DMM2 to PGND2.
5) Connect the positive terminal of EL1 to VOUT1; connect the negative terminal of EL1 to PGND1.
6) Connect the positive terminal of EL2 to VOUT2; connect the negative terminal of EL2 to PGND2.
7) Set the power supply to 14V and 3A limit. Enable power supply output.
8) The DMM1 voltmeter should display an output voltage of 5V when connected to VOUT1.
9) The DMM2 voltmeter should display an output voltage of 3.3V when connected to VOUT2.

Detailed Description

The MAX20057 EV kit provides a fully developed and proven layout for evaluating all variants of the MAX20057 family of small current-mode-controlled buck converter ICs. Each converter accepts input supply voltages as high as 36V and input supply transients up to 40V.

Switching Frequency and External Synchronization

The IC can operate in two modes, forced-PWM or skip mode. Skip mode offers improved efficiency over PWM during light-load conditions. When FSYNC is pulled low, the device operates in skip mode for light loads, and in PWM mode for larger loads. When FSYNC is pulled high, the device is forced to operate in PWM across all load conditions. The EV kit default configuration uses a shunt on JU4_FSYNC to hold FSYNC high resulting in forced-PWM mode operation.

The FSYNC pin can be used to synchronize the switching frequency of the IC to an external source by applying an external clock signal. The device is forced to operate in PWM when FSYNC is connected to a clock source.

Buck Output Monitoring (PGOOD_)

The EV kit provides output test points (PGOOD1 and PGOOD2) to monitor the status of the respective buck output voltage on VOUT1 and VOUT2. PGOOD is high impedance when the respective output voltage rises above 95% (typ) of regulation voltage. PGOOD goes low when the respective output voltage drops below 93.5% (typ) of its nominal regulated voltage.

To obtain logic signals, pull up PGOOD1 and PGOOD2 to V_{BIAS} by installing the shunts on jumpers on JU_PGOOD1 and JU_PGOOD2.

Setting the Output Voltage in Buck Converters

The EV kit comes preassembled to provide a fixed 5V voltage regulation on VOUT1. To externally adjust the voltage at VOUT1, remove R1 and place appropriate resistors in positions R3 and R4 according to the following equation:

$$R3 = R4\left[\left(\frac{V_{OUT1}}{V_{FB}}\right) - 1\right]$$

where V_{FB} = 1V (typ) and R4 = 50kΩ.

The EV kit comes preassembled to provide a fixed 3.3V voltage regulation on VOUT2. To externally adjust the voltage at VOUT2, remove R12 and place appropriate resistors in positions R15 and R16 according to the following equation:

$$R15 = R16\left[\left(\frac{V_{OUT2}}{V_{FB}}\right) - 1\right]$$

where V_{FB} = 1V (typ) and R16 = 50kΩ.

Selecting EXTVCC

The MAX20057 IC provides an internal low dropout linear regulator (LDO) that supplies the IC internal circuitry and voltage at the BIAS pin (V_{BIAS}). This LDO can be bypassed when a voltage source is detected at the EXTVCC pin in the range of 3.25V to 5.5V. The EV kit provides jumper JU5_EXTVCC, which allows shunts to be installed connecting EXTVCC to either VOUT1, VOUT2, or ground. Bypassing the internal LDO and using the switching converter output to supply V_{BIAS} increases efficiency over enabling the LDO.

When the voltage source on EXTVCC drops below 2.9V, the internal LDO is enabled to supply voltage at BIAS.

Setting Boost Output Voltage

The EV kit comes installed with the MAX20057ATIE/VY+, which provides a fixed boost output voltage. Contact Maxim Integrated Products for more information pertaining to ordering additional variants of MAX20057 with adjustable boost output voltage.

Evaluating Other Variants

The MAX20057EVKIT# comes installed with the 5V/3.3V/2.1MHz variant (MAX20057ATIE/VY+) Maxim Integrated offers additional variations including those that operate at lower switching frequency of 400kHz for increased efficiency. See *MAX20057 EV Kit Bill of Materials* to select components for evaluating 400kHz variants.

See the *MAX20057 IC Datasheet* for part variant details and contact factory for additional variants of MAX20057.

Ordering Information

PART	TYPE
MAX20057EVKIT#	5V/3.3V/2.1MHz EV Kit

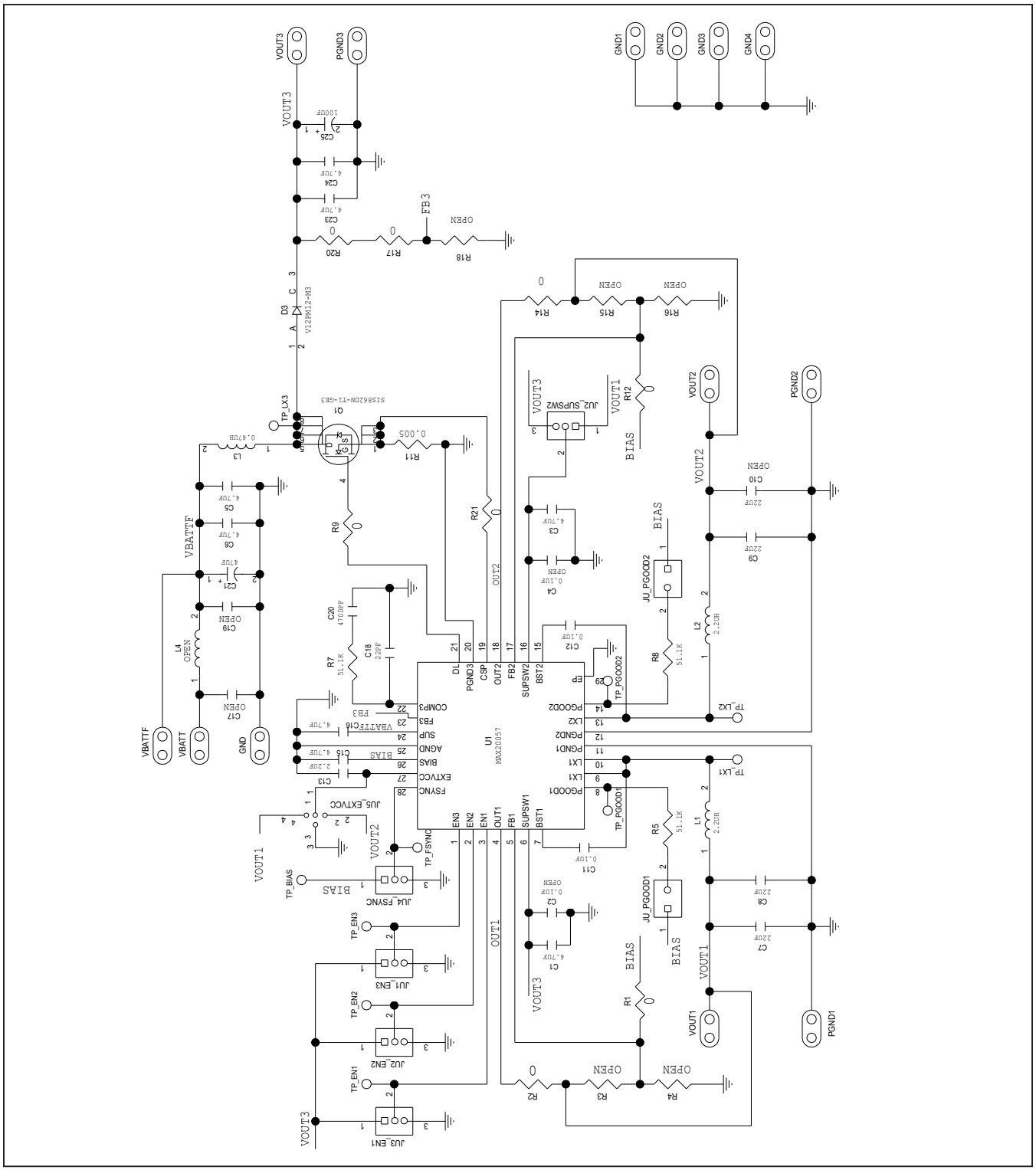
#Denotes a RoHS-compliant device that may include lead that is exempt under the RoHS requirements.

MAX20057 EV Kit Bill of Materials

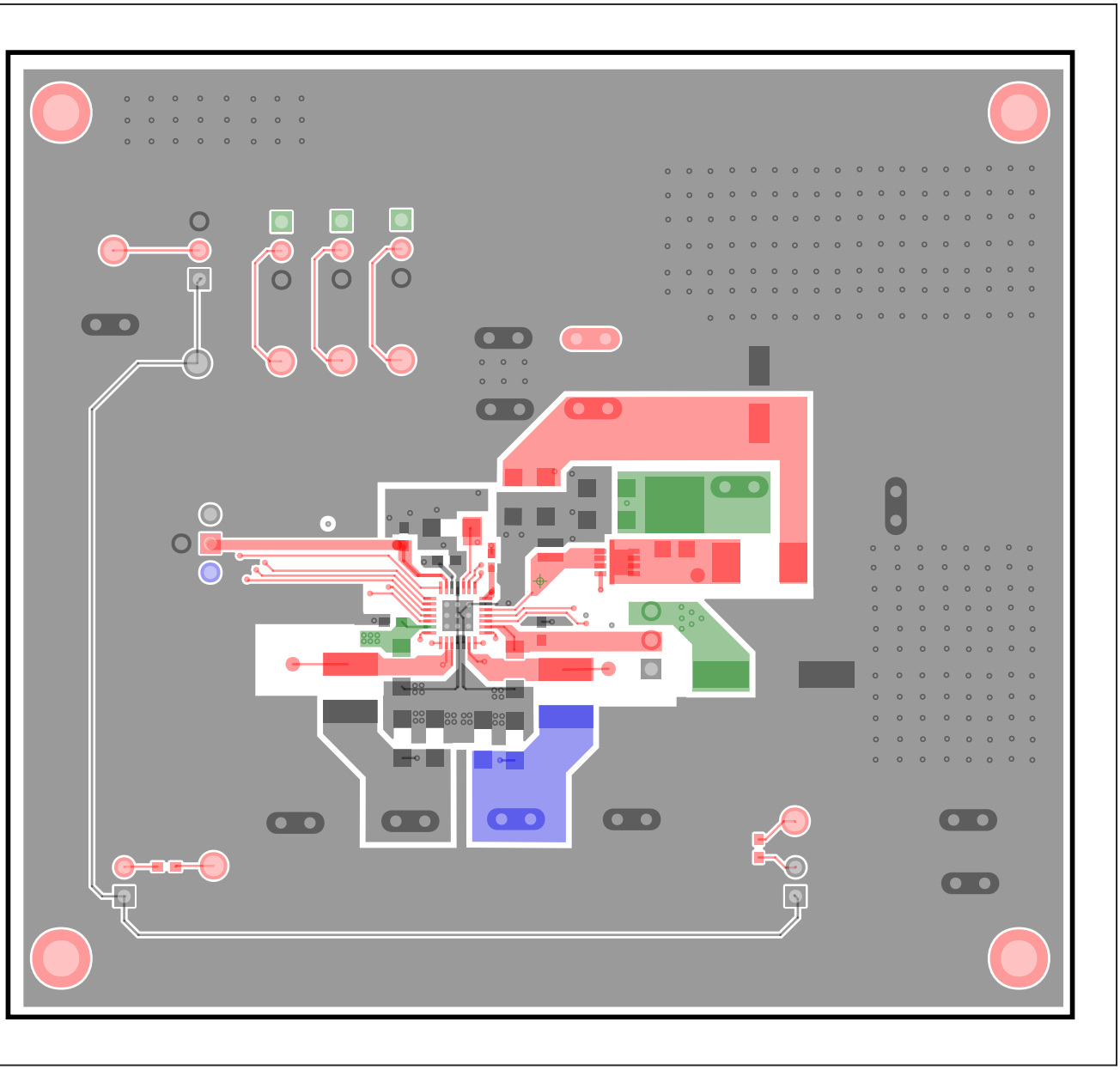
DESIGNATION	QTY	DESCRIPTION	MFG PART#
C7-C9	3	22uF ±10%, 10V X7R ceramic capacitor (1206)	MURATA GRM31CR71A226KE15
C11, C12	2	100nF ±10%, 50V X7R ceramic capacitor (0402)	TDK CGA2B3X7R1H104K
C13	1	2.2uF ±10%, 6.3V X7R ceramic capacitor (0603)	TDK CGA3E1X7R0J225K080AC
C15	1	4.7uF ±10%, 16V X7R ceramic capacitor (0603)	MURATA GRM188Z71C475KE21
C1, C3, C5, C6, C16, C23, C24	7	4.7uF ±10%, 50V X7R ceramic capacitor (1206)	TDK CGA5L3X7R1H475K160AB
C18	1	22pF ±5%, 100V C0G ceramic capcitor (0603)	MURATA GCM1885C2A220JA16
C20	1	4700pF ±5%, 100V C0G ceramic capacitor (0603)	TDK CGA3E1C0G2A472J080AC
C21	1	47uF ±20%, 50V aluminum electrolytic capacitor (CASE_D)	PANASONIC EEE-FT1H470AP
C25	1	100uF ±20%, 50V aluminum electrolytic capacitor (CASE_D)	PANASONIC EEH-ZC1H101V
D3	1	Schottky diode, 120V,12A (T0-277A)	VISHAY GENERAL V12PM12-M3
L1, L2	2	2.2uH ±20%, 9.7A composite inductor	COILCRAFT XAL5030-222ME
L3	1	0.47uH ±20%, 17.5A shielded inductor	VISHAY DALE IHLP2525CZERR47M01
Q1	1	N-Channel FET, 60V, 40A (POWERPAK 1212-8)	VISHAY SILICONIX SIS862DN-T1-GE3
R1, R2, R12, R14, R17, R20	6	0Ω ± 0%; thick film resistor (0603)	VISHAY DALE CRCW06030000Z0
R9	1	0Ω ± 0%; thick film resistor (0603)	VISHAY DALE CRCW04020000Z0EDHP
R11	1	0.005Ω ±1%, 1W metal film resistor (2012)	SUSUMU CO LTD. KRL2012E-M-R005-F-T5
R5, R7, R8	3	51.1kΩ ± 1%, 0.1W thick film resistor (0603)	VISHAY DALE CRCW060351K1FK
U1	1		MAX20057ATIE/VY+
—	1	PCB: MAX20457 Evaluation Kit	

CHANGES FOR 400kHz VERSION			
DESIGNATION	**QTY**	**DESCRIPTION**	**MFG PART #**
C7-C9	3	47uF ±10% 10V Ceramic Capacitor X7R (1210)	MURATA GRM32ER71A476KE15L
C10	1	22uF ±10%, 10V X7R ceramic capacitor (1206)	MURATA GRM31CR71A226KE15
L1,L2	2	10uH ±20% Composite Inductor	COILCRAFT XAL5050-103MEB

MAX20057 EV Kit Schematic

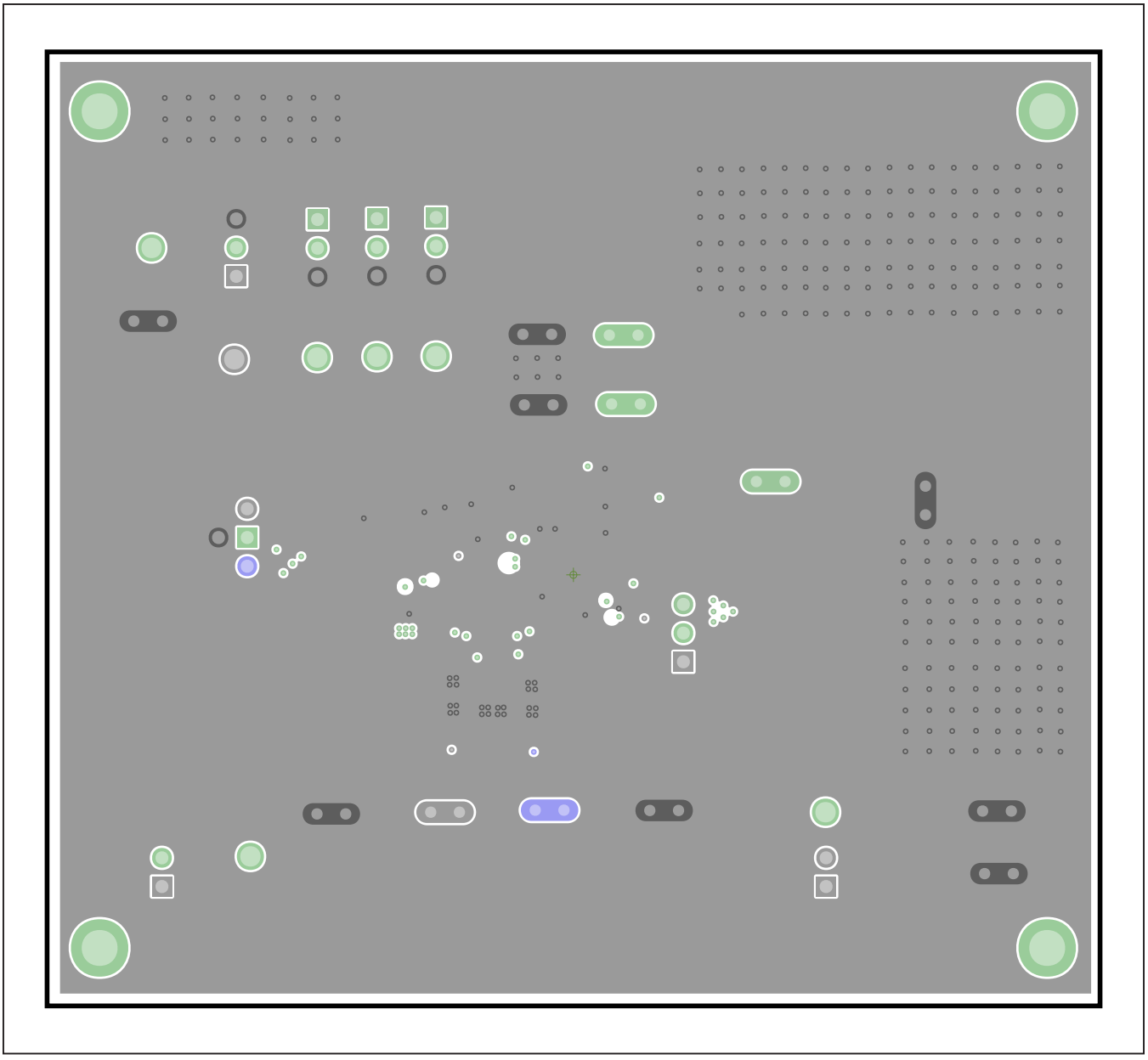


MAX20057 EV Kit PCB Layout Diagrams



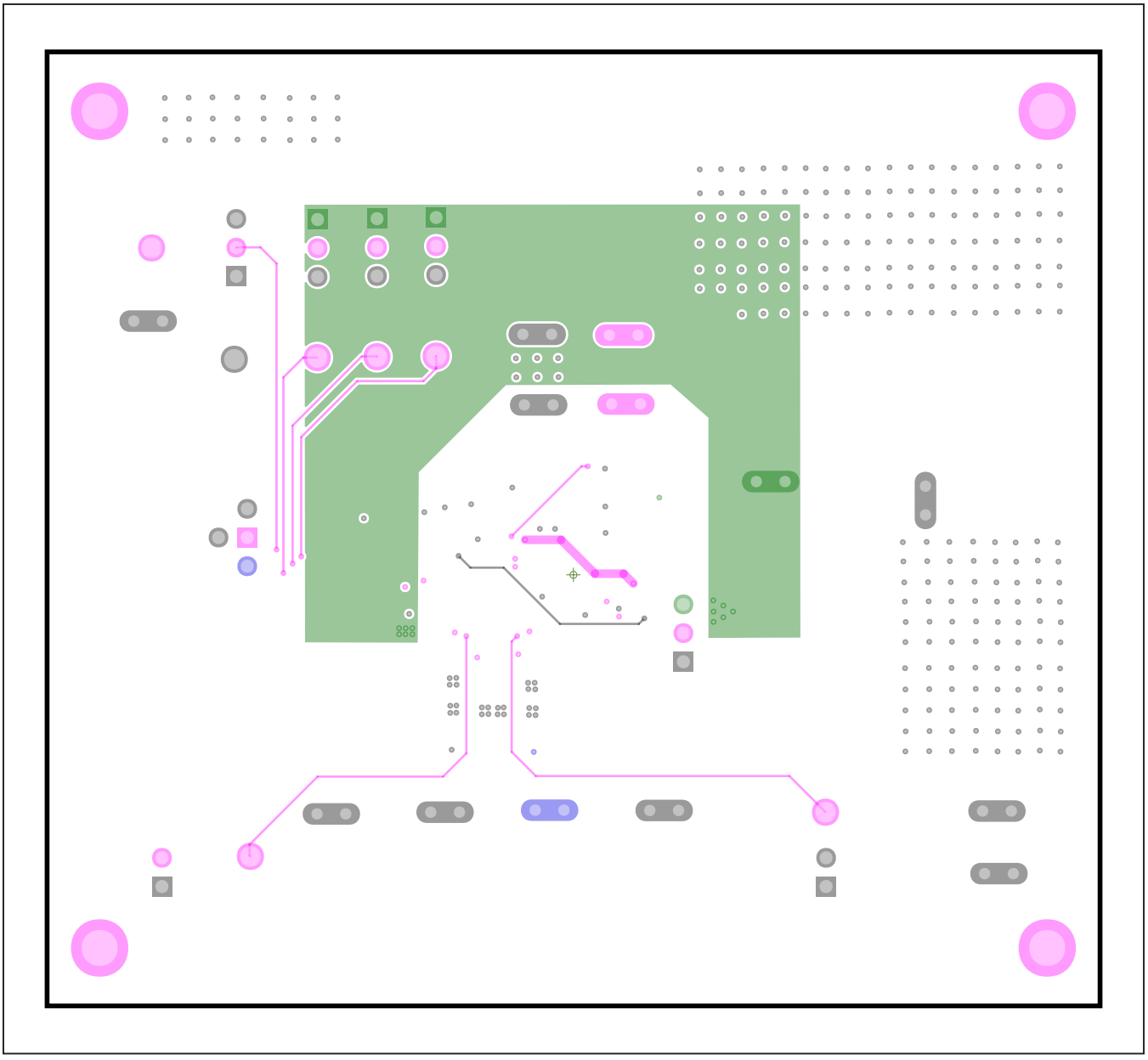
MAX20057 EV Kit Component Placement - Top

MAX20057 EV Kit PCB Layout Diagrams (continued)



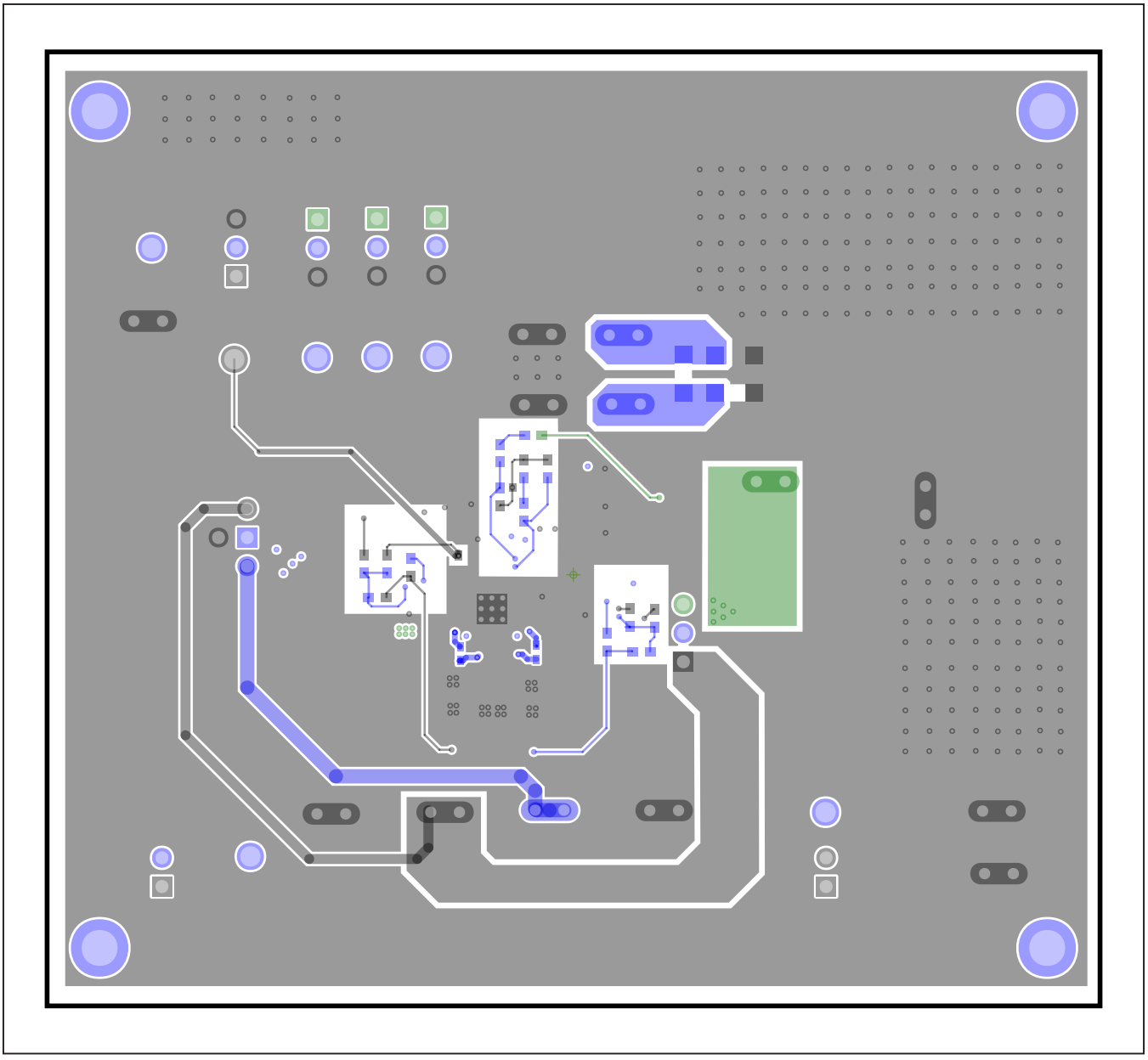
MAX20057 EV Kit PCB Layout - Internal Layer 2

MAX20057 EV Kit PCB Layout Diagrams (continued)



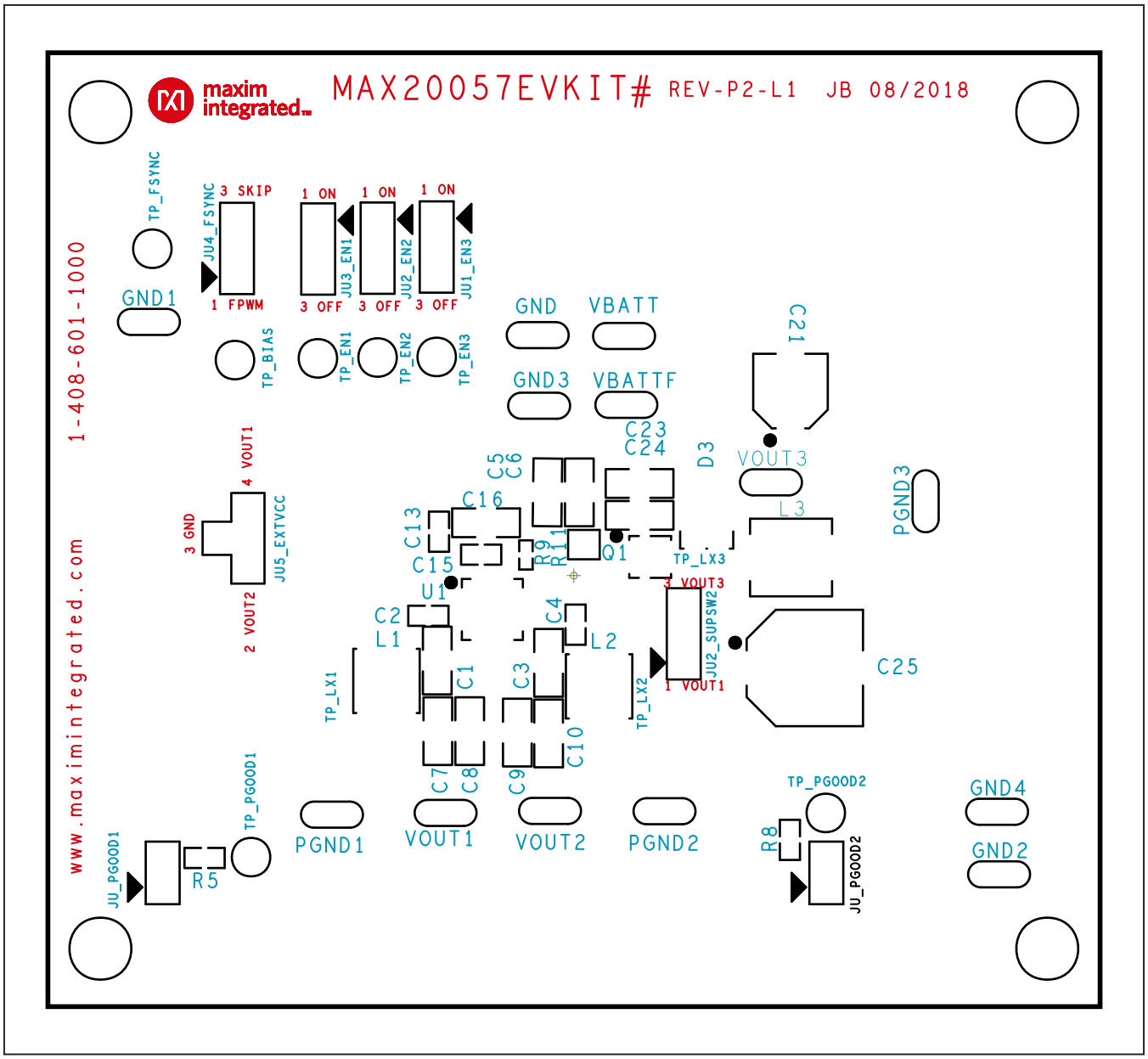
MAX20057 EV Kit PCB Layout - Internal Layer 3

MAX20057 EV Kit PCB Layout Diagrams (continued)



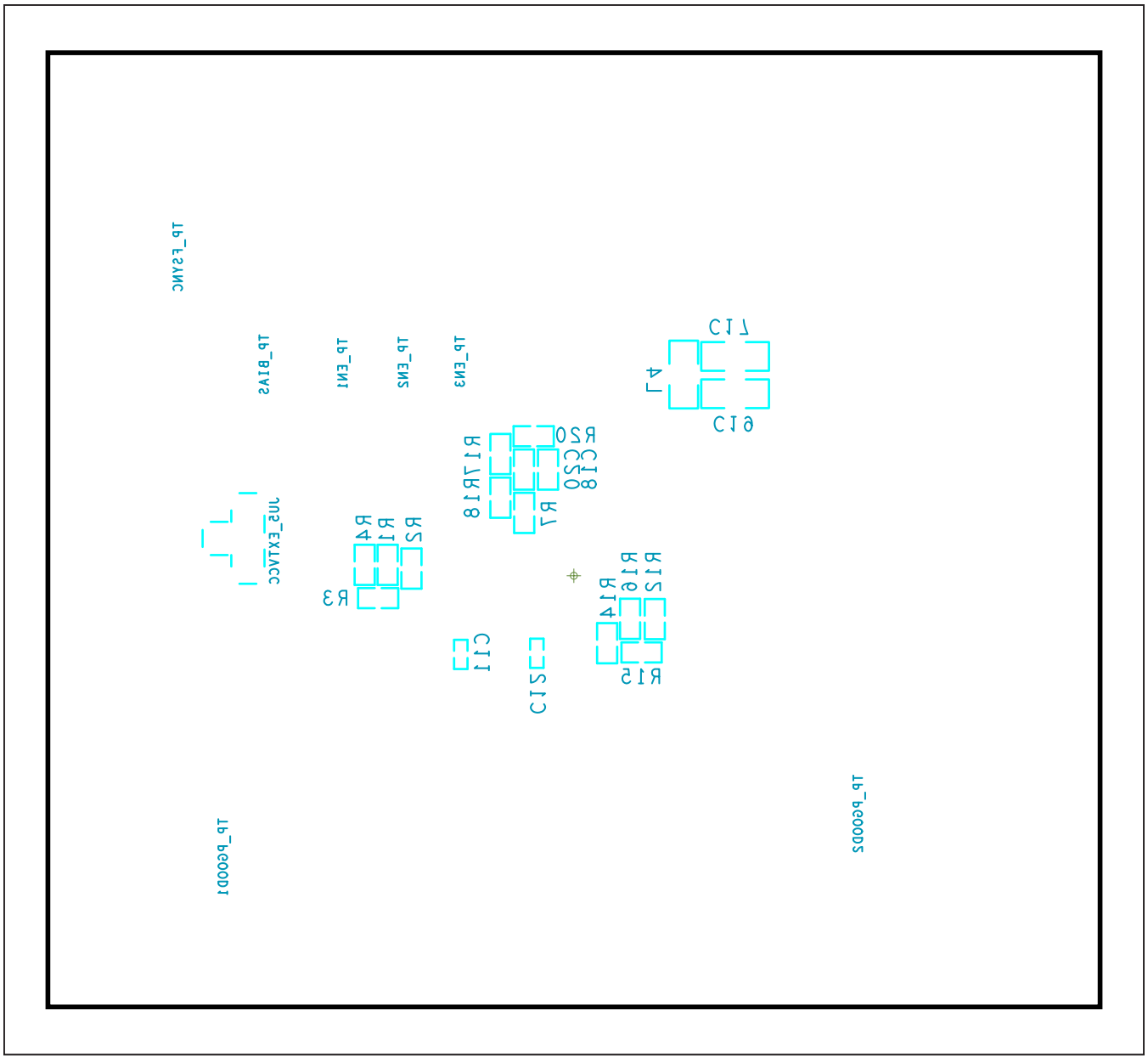
MAX20057 EV Kit Component Placement - Bottom

MAX20057 EV Kit PCB Layout Diagrams (continued)



MAX20057 EV Kit Component Placement - Silk Top

MAX20057 EV Kit PCB Layout Diagrams (continued)



MAX20057 EV Kit Component Placement - Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	2/19	Initial release	—
1	10/19	Updated *MAX20057 EV Kit Bill of Materials* section	4
2	1/20	Updated *MAX20057 EV Kit Schematic* section	5