MAX20457 Evaluation Kit

Evaluates: MAX20457

General Description

The MAX20457 evaluation kit (EV kit) is a fully assembled and tested application circuit that simplifies the evaluation of the MAX20457 2.1MHz 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 MAX20457ATIE/VY+ installed (5V, 3.3V, 2.1MHz) and can also be used to evaluate other MAX20457 variants with minimal component changes shown in the MAX20457 EV Kit Bill of Materials.

Benefits and Features

- Dual High-Voltage Step-Down Converters with Integrated Power FETs to Minimize Board-Area Occupancy
- 3.5V to 40V Input Supply Range
- 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 14V 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

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

Quick Start

Required Equipment

- MAX20457 EV kit
- 15V, 7A DC power supply (PS1)
- Two voltmeters (VM1 and VM2)
- Two electronic loads (EL1 and EL2)

Procedure

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

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

1) Verify that all jumpers are in their default positions as shown in Table 1.
2) Preset the power supply PS1 to 14V. Turn off the PS1.
3) Preset EL1 to 3A. Turn off the EL1.
4) Preset EL2 to 1.5A. Turn off the EL2.
5) Connect the positive terminal of EL1 to V_{OUT1}; connect the negative terminal of EL1 to PGND1.
6) Connect the positive terminal of EL2 to V_{OUT2}; connect the negative terminal of EL2 to PGND2.
7) Connect the positive terminal of PS1 to the V_{BATTF}; connect the negative terminal of PS1 to GND3.
8) Connect the positive terminal of VM1 to V_{OUT1}; connect the negative terminal of VM1 to PGND1.
9) Connect the positive terminal of VM2 to V_{OUT2}; connect the negative terminal of VM2 to PGND2.
10) Turn on the power supply.
11) Enable the electronic loads, EL1 and EL2.
12) Verify that the voltmeter on V_{OUT1} measures approximately 5V.
13) Verify that the voltmeter on V_{OUT2} measures approximately 3.3V.

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Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	FUNCTION
JU3_EN1	1-2	Buck1 controller enabled
JU2_EN2	1-2	Buck2 controller enabled
JU2_SUPSW2	2-3	Buck2 input supplied by V_{BATTF}
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 V_{OUT1}

Detailed Description

The MAX20457 EV kit provides a fully developed and proven layout for evaluating all variants of the MAX20457 family of 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 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 V_{OUT1} and V_{OUT2}. PGOOD is high impedance when the respective output voltage rises above its 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 V_{OUT1}. To externally adjust the voltage at V_{OUT1}, remove R1 and place appropriate resistors in positions R3 and R4 according to the following equation:

$$R3 = R4\left[\left(\frac{VOUT1}{VFB}\right) - 1\right]$$

where VFB = 1V (typ) and R4 = 50kΩ.

The EV kit comes preassembled to provide a fixed 3.3V voltage regulation on V_{OUT2}. To externally adjust the voltage at V_{OUT2}, remove R12 and place appropriate resistors in positions R15 and R16 according to the following equation:

$$R15 = R16\left[\left(\frac{VOUT2}{VFB2}\right) - 1\right]$$

where VFB2 = 1V (typ) and R16 = 50kΩ.

Selecting EXTVCC

The MAX20457 IC provides an internal 5V BIAS LDO that supplies the IC internal circuitry. This LDO can be bypassed when a voltage source in the range of 3.25V to 5.5V is detected at the EXTVCC pin. The EV kit provides jumper JU5_EXTVCC, which allows shunts to be installed connecting EXTVCC to either V_{OUT1} or V_{OUT2}. This bypasses the internal LDO and uses the switching converter output to supply V_{BIAS}, providing increased efficiency over enabling the LDO. Connecting EXTVCC to GND enables the internal LDO to supply V_{BIAS}.

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

Evaluating Other Variants

The MAX20457EVKIT# comes installed with the 5V/3.3V/2.1MHz variant (MAX20457ATIE/VY+).

Maxim offers additional variations, including those that operate at the lower switching frequency of 400kHz for increased efficiency. See MAX200457 EV Kit Bill of Materials to select components for evaluating 400kHz variants.

See the MAX20457 IC Datasheet for part variant details and contact the factory for additional variants of MAX20457.

Ordering Information

PART	TYPE
MAX20457EVKIT#	5V/3.3V/2.1MHz EV Kit

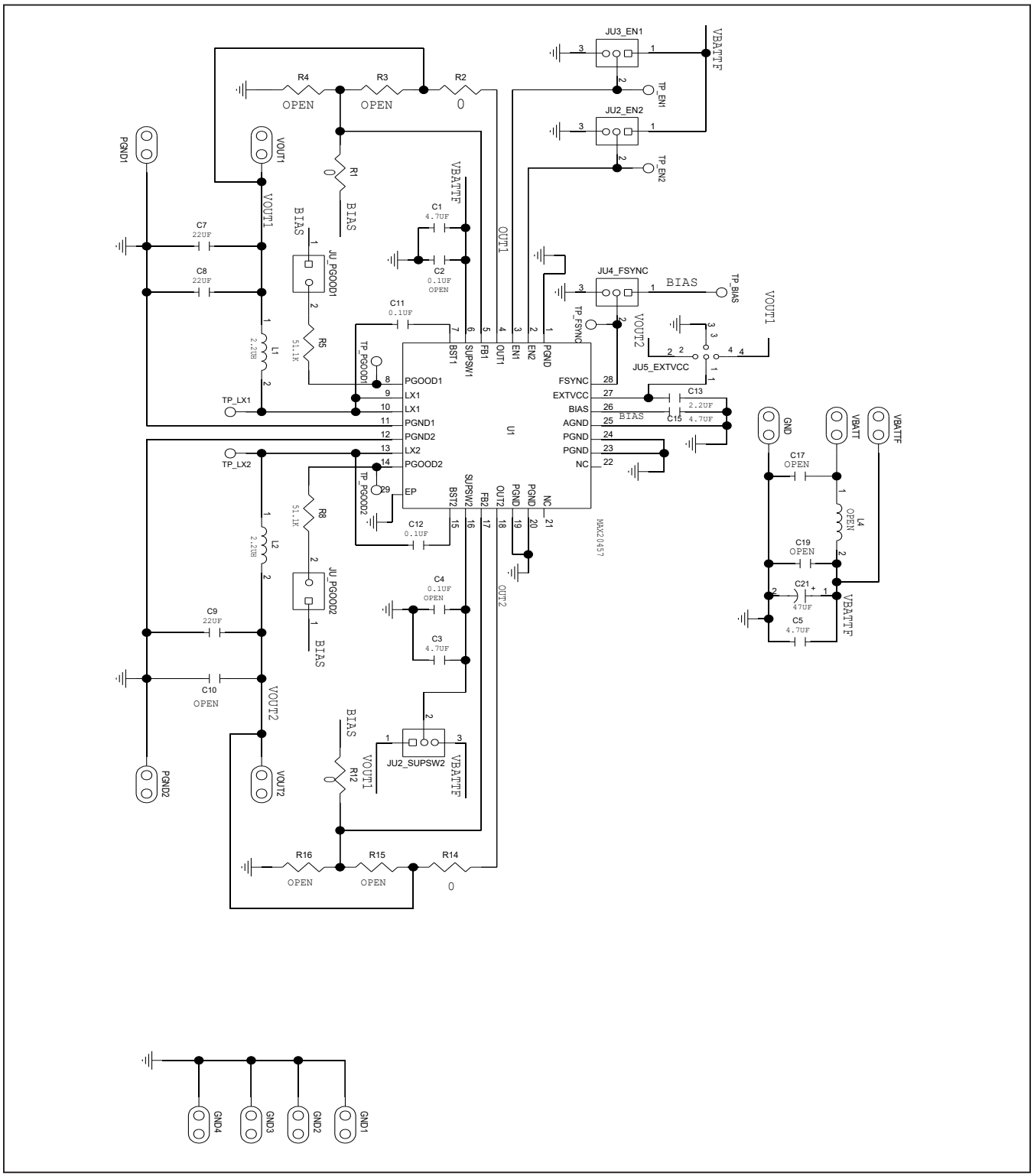
#Denotes RoHS compliant.

MAX20457 EV Kit Bill of Materials

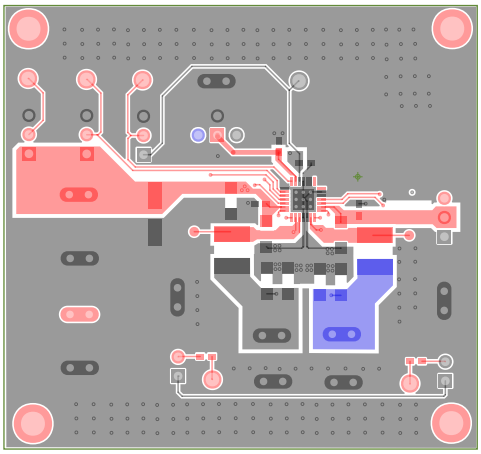
DESIGNATION	QTY	DESCRIPTION	MFG PART #
C7-C9	3	22µF ±10%, 10V X7R ceramic capacitor (1206)	MURATA GRM31CR71A226KE15
C11, C12	2	100µF ±10%, 50V X7R ceramic capacitor (0402)	TDK CGA2B3X7R1H104K
C13	1	2.2µF ±10%, 6.3V X7R ceramic capacitor (0603)	TDK CGA3E1X7R0J225K080AC
C15	1	4.7µF ±10%, 16V X7R ceramic capacitor (0603)	MURATA GRM188Z71C475KE21
C1, C3, C5	3	4.7µF ±10%, 50V X7R ceramic capacitor (1206)	TDK CGA5L3X7R1H475K160AB
C21	1	47µF ±20%, 50V aluminum electrolytic capacitor (CASE_D)	PANASONIC EEE-FT1H470AP
L1, L2	2	2.2µH ±20%, 9.7A composite inductor	COILCRAFT XAL5030-222ME
R1,R2, R12, R14	4	0Ω ± 0%; thick film resistor (0603)	VISHAY DALE CRCW06030000Z0
R5, R8	2	51.1kΩ ±1%, 0.1W thick film resistor (0603)	VISHAY DALE CRCW060351K1FK
U1	1	36V Dual Synchronous Buck Converter	MAX20457ATIE/VY+
-	1	PCB: MAX20457 Evaluation Kit	

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

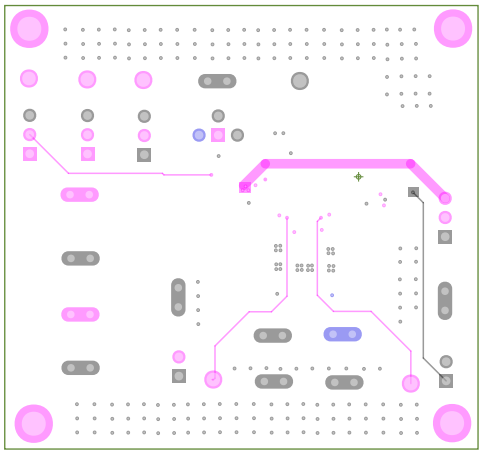
MAX20457 EV Kit Schematic



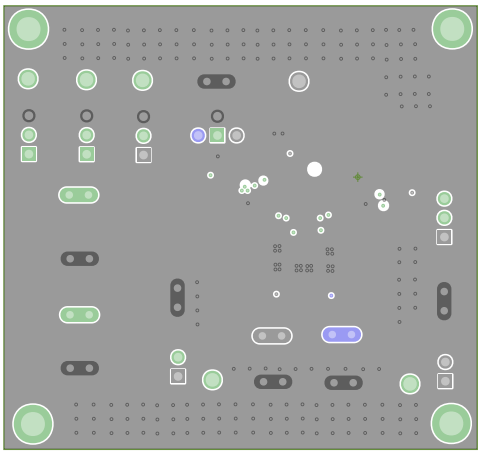
MAX20457 EV PCB Layouts



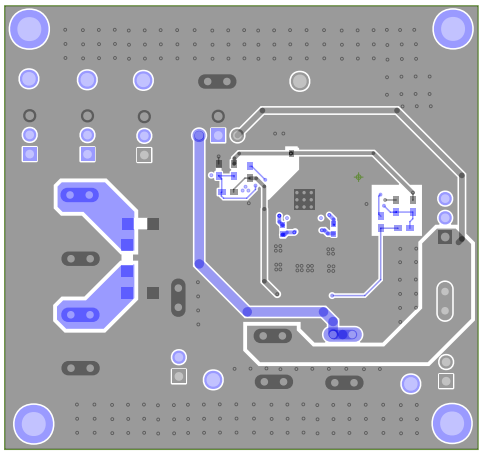
MAX20457 EV Kit Component Placement - Top



MAX20457 EV Kit PCB Layout - Internal Layer 3

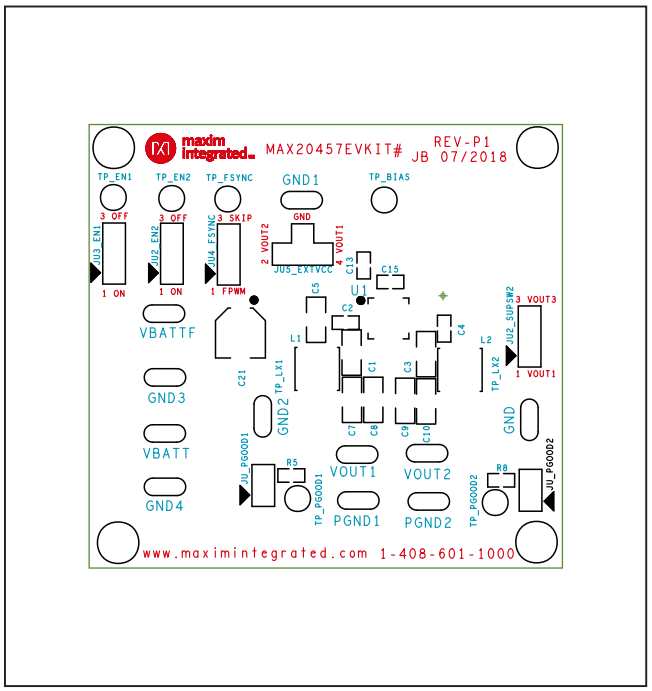


MAX20457 EV Kit PCB Layout - Internal Layer 2

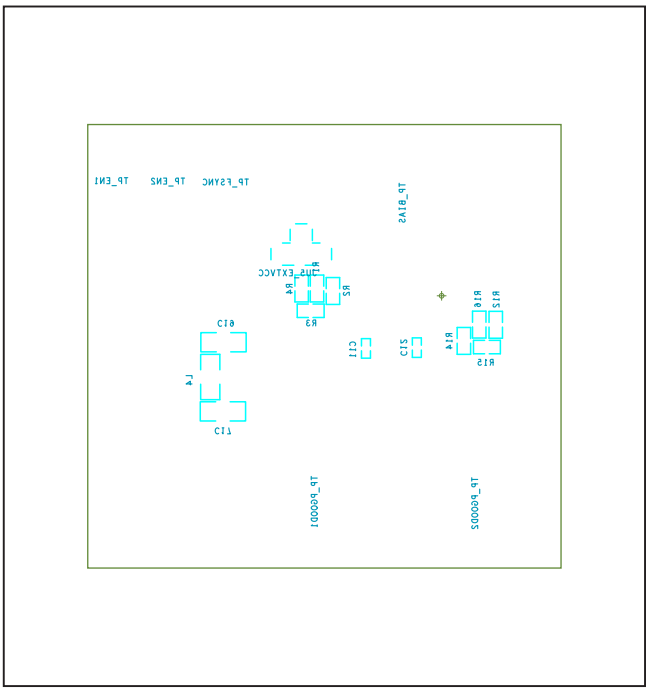


MAX20457 EV Kit Component Placement - Bottom

MAX20457 EV PCB Layouts (continued)



MAX20457 EV Kit Silkscreen Top



MAX20457 EV Kit Silkscreen Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/19	Initial release	—

