User's Guide

TPS62184 Buck Converter Evaluation Module User's Guide

ABSTRACT

This user's guide describes the characteristics, operation, and use of TI's TPS62184 evaluation module (EVM). The TPS62184EVM-581 (PWR581-002) facilitates the evaluation of the TPS62184 6-A, 2-phase buck converter. The EVM outputs a 1.8-V output voltage from input voltages between 4 V and 17 V. The TPS62184 features Automatic Efficiency Enhancement (AEE™) to deliver efficiencies in excess of 90% across the load current range. The small solution size (99 mm^2) and low profile possible enable a very dense power solution in tablets, Solid State Drives (SSDs), and other portable devices. This user's guide includes setup instructions for the hardware, a printed-circuit board layout for the EVM, a schematic diagram, a bill of materials (BOM), and test results for the EVM.

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1 Introduction

The TPS62184 is a 6-A, dual-phase, synchronous, step-down converter in a 2 × 3-mm, WCSP package.

1.1 Performance Specification

Table 1-1 provides a summary of the TPS62184EVM-581 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1-1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input voltage		4		17	V
Output voltage setpoint			1.8		V
Output current	V_{OUT} ≤ 1.8 V	0		6	A
	V_{OUT} > 1.8 V and ≤ 2.5 V	0		5.5	A
	V_{OUT} > 2.5 V and ≤ 3.5 V	0		5	A
Soft-start time	Ramp time of V_{OUT}		825		µs

1.2 Modifications

The output voltage of the EVM may be adjusted within the range stated in the device data sheet. Additional input and output capacitors can also be added. A lower profile inductor may also be used to reduce the total solution height. Finally, the input voltage at which the IC turns on can be adjusted with two resistors.

1.2.1 Changing the Output Voltage

The output voltage may be adjusted by changing the values of R1 and R2. Be sure and keep the output voltage within the range specified in the device data sheet. Setting an output voltage above 1.8 V reduces the maximum amount of current which can reliably be delivered, per Table 1-1. See the data sheet for details.

1.2.2 Input and Output Capacitors

C13 and C14 are provided for additional input capacitors. These capacitors are not required for proper operation but can be used to reduce the input voltage ripple.

C7, C8, C9, C10, C11, and C12 are provided for additional output capacitors. These capacitors are not required for proper operation but can be used to reduce the output voltage ripple and to improve the load transient response. The total output capacitance must remain within the recommended range in the TPS62184 data sheet (SLVSCQ5) for proper operation.

1.2.3 Lower Profile Solutions

The TPS62184EVM-581 supports modifications to achieve a lower total solution profile (height). The current EVM gives a maximum height of 2.1 mm. To obtain a lower profile solution, replace both inductors L1 and L2 with a suitable inductor of lower height. An option is the DFE252012P series from Toko which has a maximum profile of 1.2 mm. These inductors fit well on the existing pads for L1 and L2.

1.2.4 Configurable Enable Threshold Voltage

With JP1 removed, R4 and R5 can be installed to set a user-selectable input voltage at which the IC turns on. See the equations in the data sheet for details of calculating the resistor values.

2 Setup

This section describes how to properly use the TPS62184EVM-581.

2.1 Input/Output Connector Descriptions

J1 – VIN	Positive input connection from the input supply for the EVM
J2 – S+/S–	Input voltage sense connections. Measure the input voltage at this point.
J3 – GND	Return connection from the input supply for the EVM
J4 – VOUT	Output voltage connection
J5 – S+/S–	Output voltage sense connections. Measure the output voltage at this point.
J6 – GND	Output return connection
J7 – PG/GND	The PG output appears on pin 1 of this header with a convenient ground on pin 2
J8 – SS/TR/GND	The SS/TR pin voltage appears on pin 2 of this header with a convenient ground on pin 1
JP1 – EN	EN pin input jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC. Remove the jumper to set a configurable enable threshold voltage with R4 and R5.
JP2 – PG Pullup Voltage	PG pin pullup voltage jumper. Place the supplied jumper on JP2 to connect the PG pin pullup resistor to the output voltage. Alternatively, the jumper can be removed and a different voltage can be supplied on pin 1 to pull up the PG pin to a different level. This externally applied voltage must remain below 7 V.

2.2 Setup

To operate the EVM, set jumpers JP1 and JP2 to the desired positions per Section 2.1. Connect the input supply to J1 and J3 and connect the load to J4 and J6.

3 TPS62184EVM-581 Test Results

The TPS62184EVM-581 was used to take the data in the TPS62184 data sheet (SLVSCQ5). See the device data sheet for the performance of this EVM.

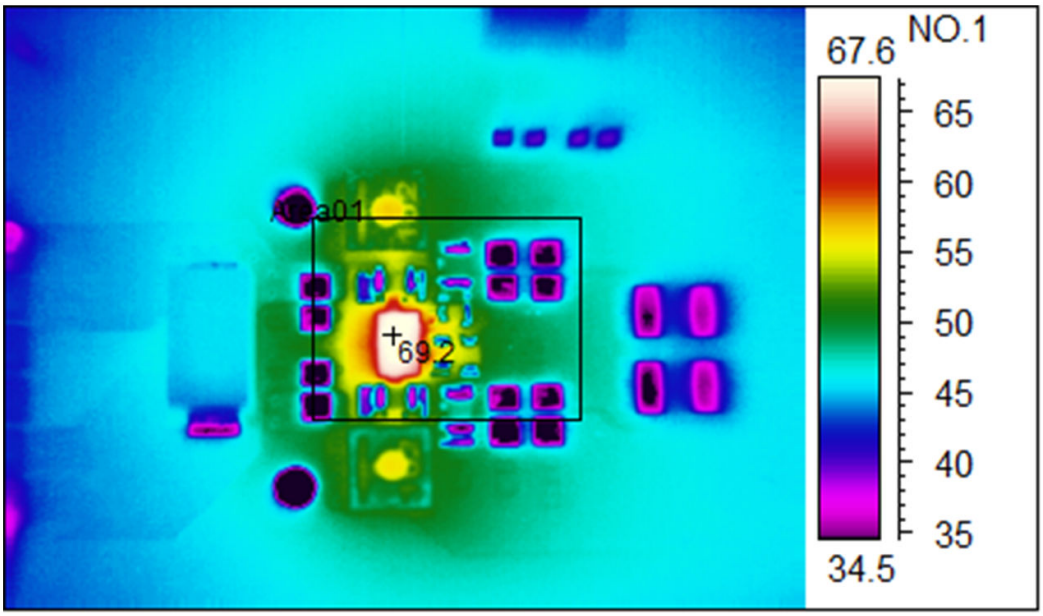

Figure 3-1. Thermal Performance (V_{IN} = 17 V, Load = 6 A)

WARNING

Hot surface. Contact may cause burns. Do not touch!

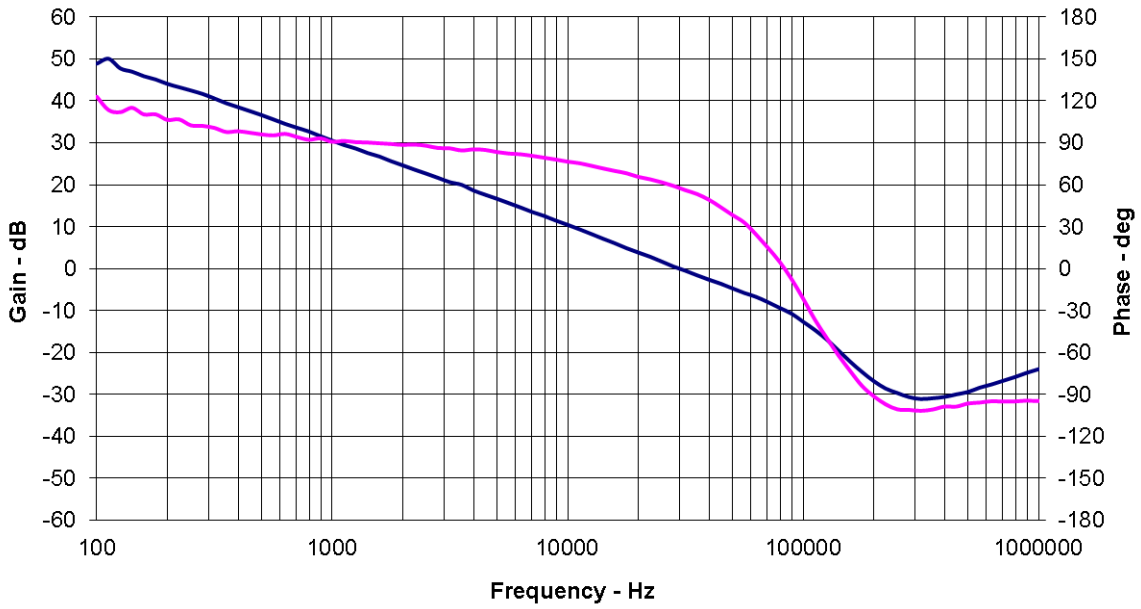

Figure 3-2. Loop Measurement (V_{IN} = 12 V, Load = 6 A, 50-Ω resistor added in series with R1)

4 Board Layout

This section provides the TPS62184EVM-581 board layout and illustrations. The Gerbers are available on the EVM product page: TPS62184EVM-581. Rev. B of the PCB just filled the vias under U1 to improve manufacturability. No copper changes were made from Rev. A.

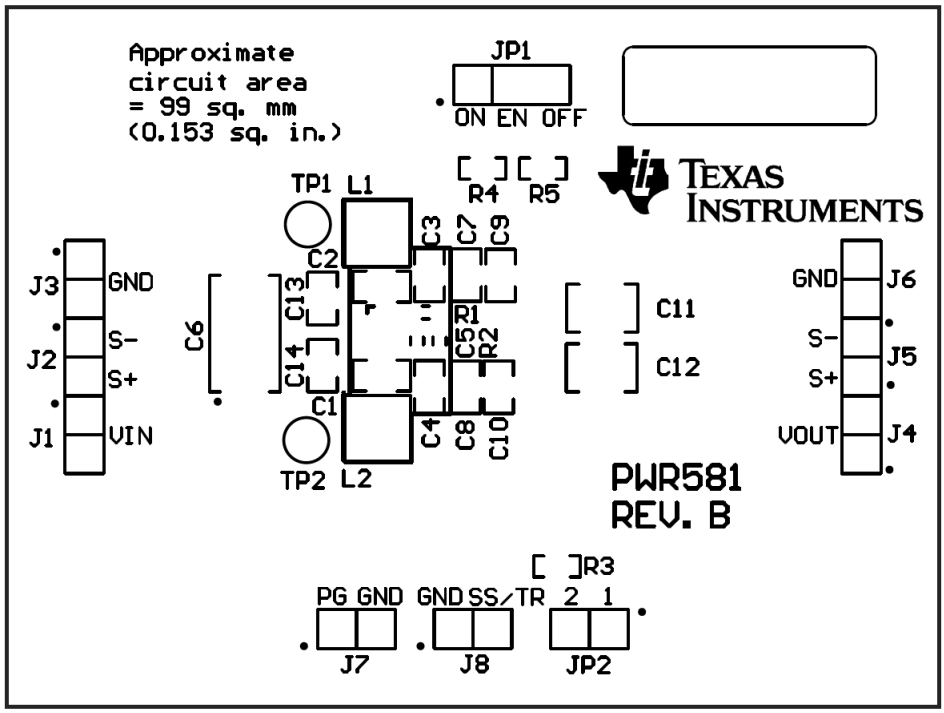

Figure 4-1. Assembly Layer

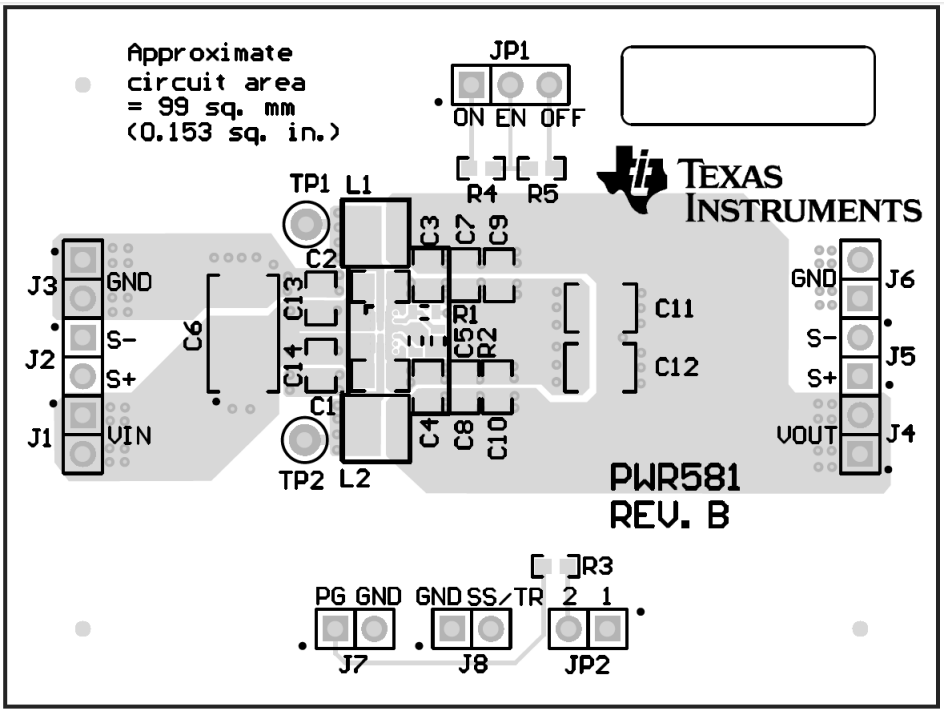

Figure 4-2. Top Silk Layer

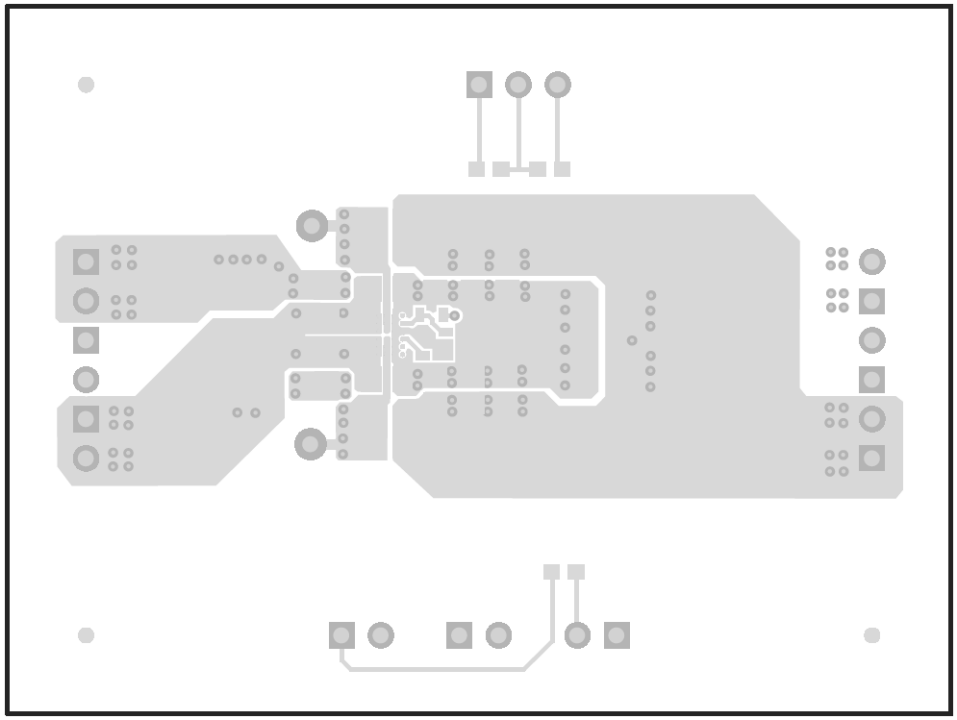

Figure 4-3. Top Layer

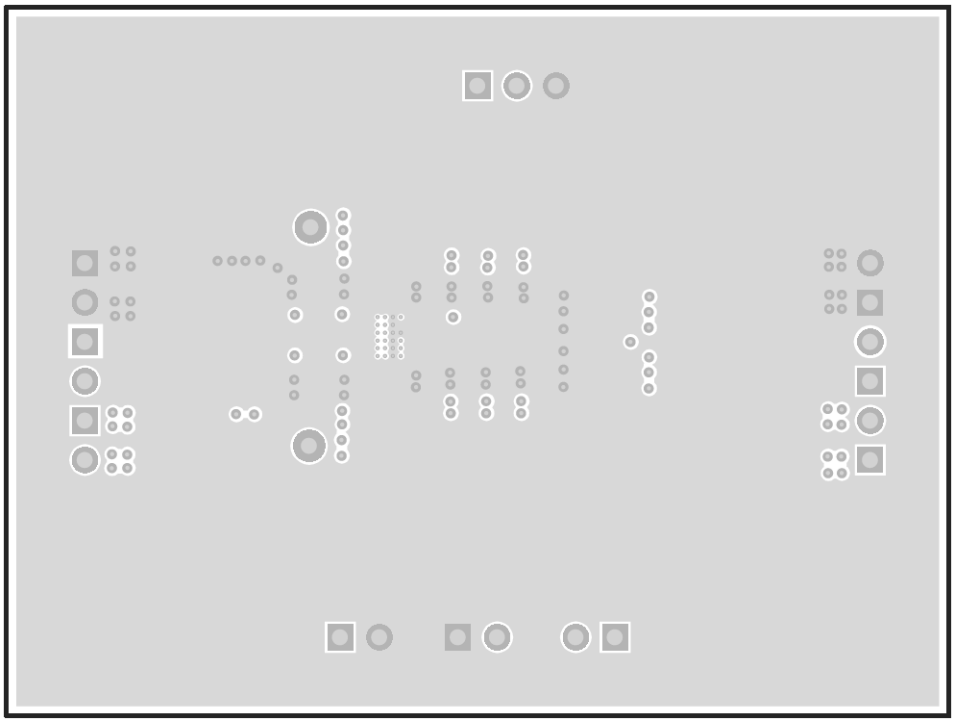

Figure 4-4. Internal Layer 1

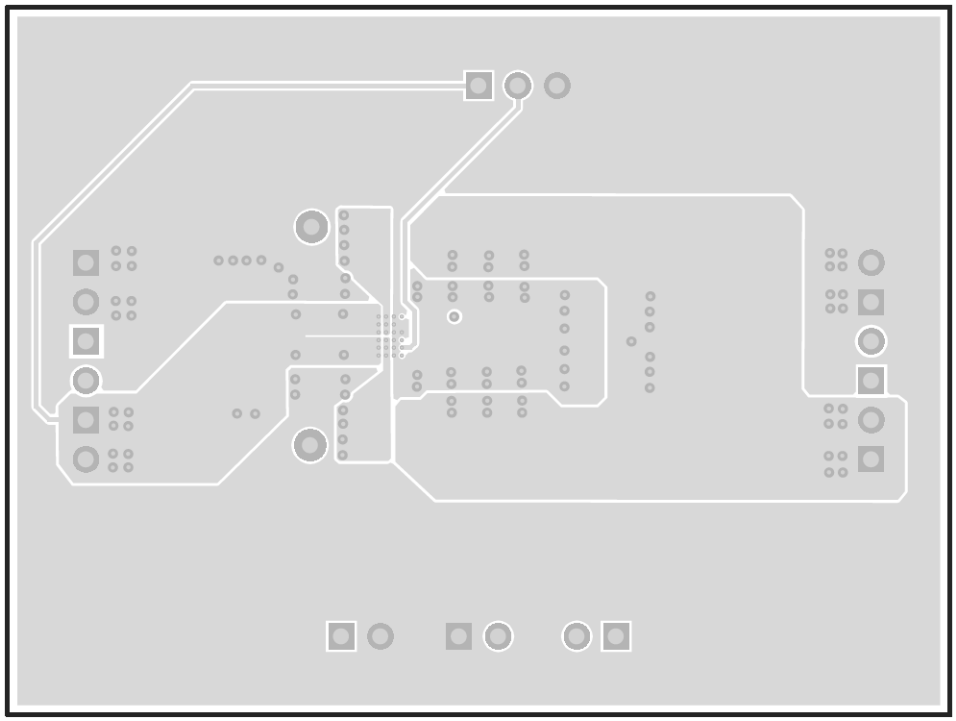

Figure 4-5. Internal Layer 2

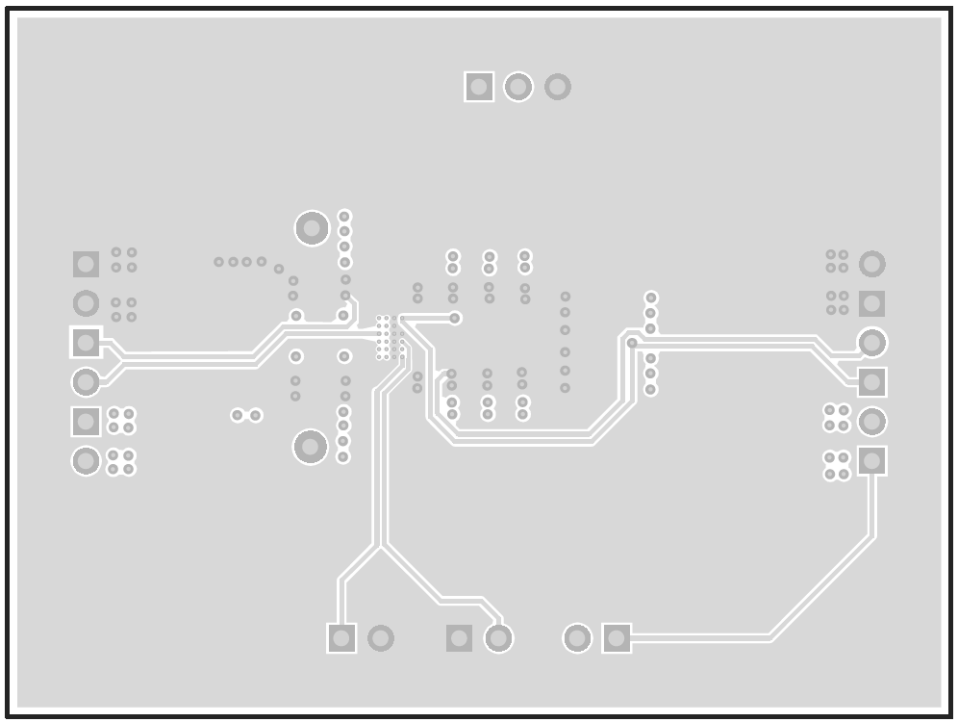

Figure 4-6. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS62184EVM-581 schematic and bill of materials.

5.1 Schematic

Figure 5-1 illustrates the TPS62184EVM-581 schematic.

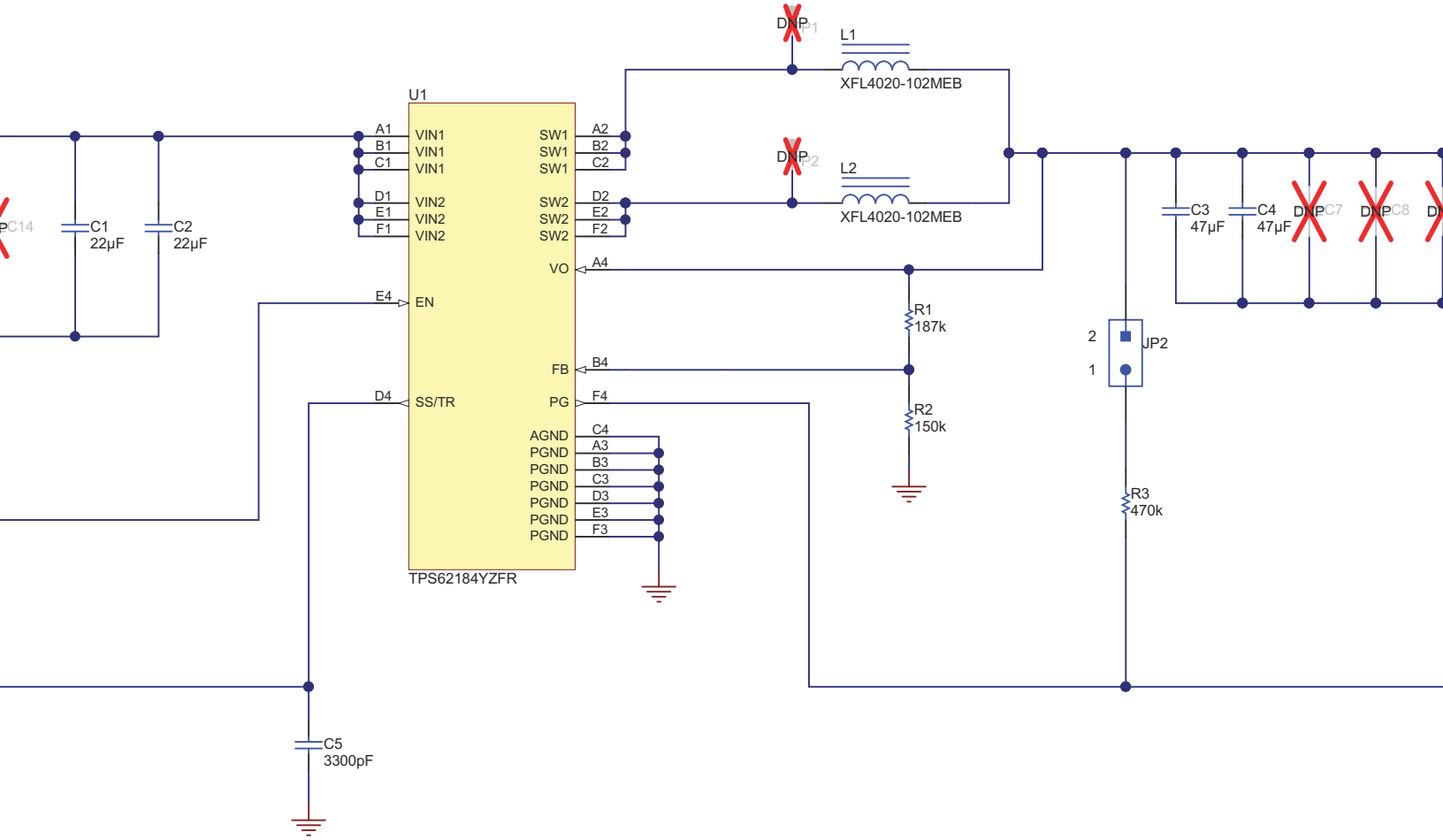

Figure 5-1. TPS62184EVM-581 Schematic

5.2 Bill of Materials

Table 5-1 lists the BOM for this EVM.

Table 5-1. TPS62184EVM-581 Bill of Materials

Quantity	Ref Des	Value	Description	Size	Part Number	Manufacturer
2	C1, C2	22uF	CAP, CERM, 22uF, 25V, +/-20%, X5R, 0805	0805	GRM21BR61E226ME44L	MuRata
2	C3, C4	47uF	CAP, CERM, 47uF, 10V, +/-20%, X5R, 0805	0805	GRM21BR61A476ME15L	MuRata
1	C5	3300pF	CAP, CERM, 3300pF, 25V, +/-10%, X7R, 0603	0603	GRM188R71E332KA01D	MuRata
1	C6	100uF	CAP, TA, 100uF, 20V, +/-10%, 0.5 ohm, SMD	7343-43	293D107X9020E2TE3	Vishay-Sprague
2	L1, L2	1uH	Inductor, Shielded, Composite, 1uH, SMD	4x2x4mm	XFL4020-102ME or XAL4020-102ME	Coilcraft
1	R1	187k	RES, 187k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07187KL	Yageo America
1	R2	150k	RES, 150k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07150KL	Yageo America
1	R3	470k	RES, 470k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07470KL	Yageo America
1	U1	TPS62184	4 - 17V, 6A, 2-Phase Step-Down Converter	2x3mm	TPS62184YZF	Texas Instruments

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (March 2015) to Revision A (May 2021)	Page
• Updated user's guide title	2
• Updated the numbering format for tables, figures, and cross-references throughout the document.	2

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