TPS62180EVM-581 Evaluation Module

This user's guide describes the characteristics, operation, and use of TI's TPS62180 evaluation module (EVM). The TPS62180EVM-581 (PWR581-001) facilitates the evaluation of the TPS62180 6-A, 2-phase buck converter. The EVM outputs a 3.3-V output voltage from input voltages between 4 V and 15 V. The TPS62180 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 TPS62180 is a 6-A, dual-phase, synchronous, step-down converter in a 2 × 3-mm, WCSP package. Both fixed and adjustable output voltage units are available.

AEE is a trademark of Texas Instruments.

1.1 Performance Specification

Table 1 provides a summary of the TPS62180EVM-581 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1. Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input voltage		4		15	V
Output voltage setpoint			3.3		V
Output current		0		6	A
Soft-start time	Ramp time of V_{OUT}		825		µs

1.2 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate the fixed output voltage version of the integrated circuit (IC). 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 Fixed Output Voltage Operation

U1 can be replaced with the fixed output voltage version of the IC for evaluation. For fixed output voltage version operation, replace R2 with a 0-Ω resistor and remove R1.

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 TPS62180 data sheet (SLVSBB8) for proper operation.

1.2.3 Lower Profile Solutions

The TPS62180EVM-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 TPS62180EVM-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 TPS62180EVM-581 Test Results

The TPS62180EVM-581 was used to take the data in the TPS62180 data sheet (SLVSBB8). See the device data sheet for the performance of this EVM.

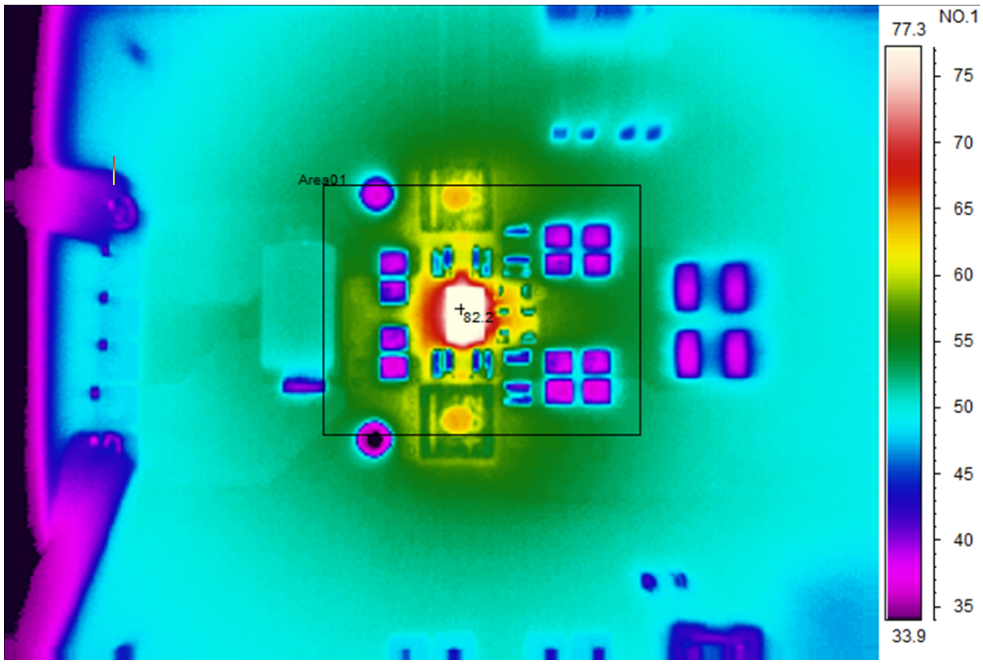

Figure 1. Thermal Performance (V_{IN} = 15 V, Load = 6 A)

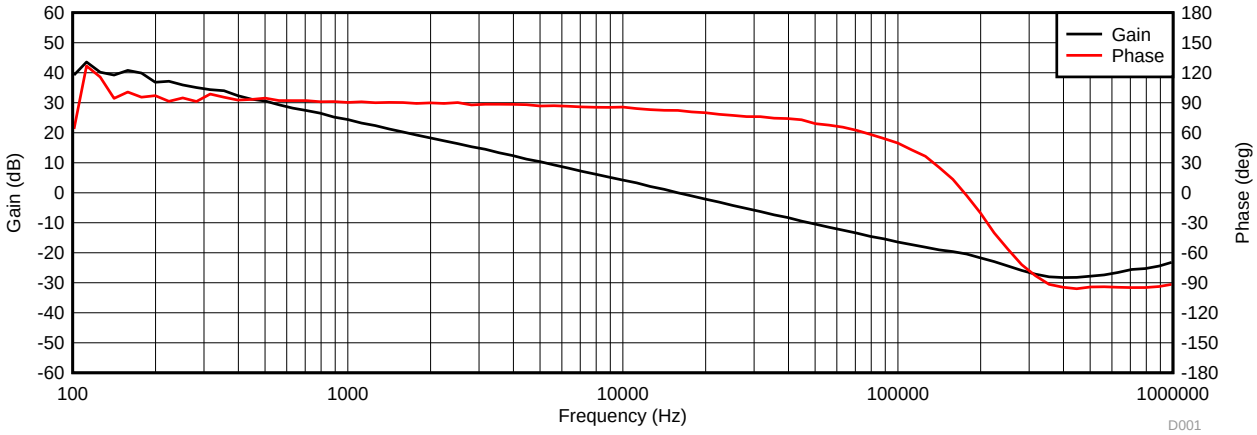

Figure 2. Loop Measurement (V_{IN} = 12 V, Load = 6 A, 50-Ω resistor added in series with R1)

4 Board Layout

This section provides the TPS62180EVM-581 board layout and illustrations. The Gerbers are available on the EVM product page: TPS62180EVM-581. Rev. B of the PCB just filled the vias under U1 to improve manufacturability. No copper changes were made from Rev. A.

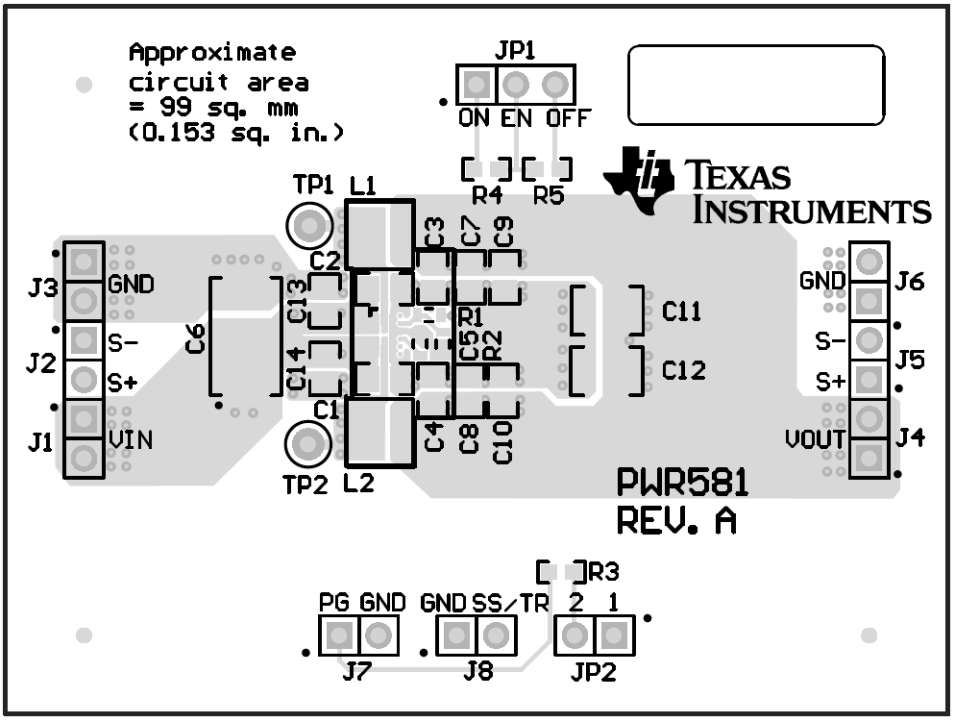

Figure 3. Assembly Layer

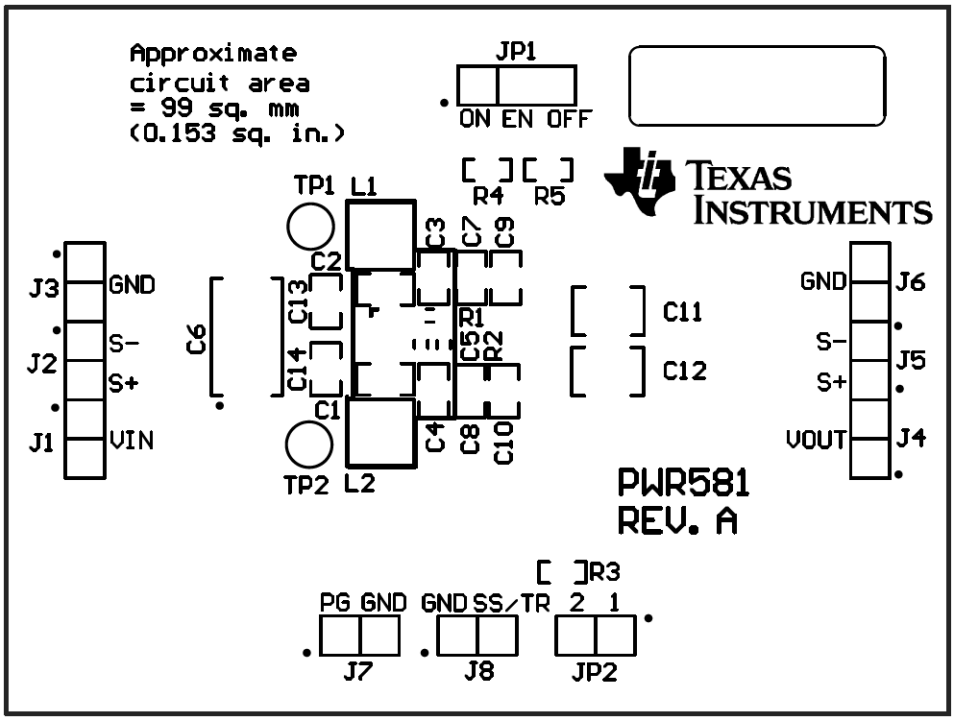

Figure 4. Top Silk Layer

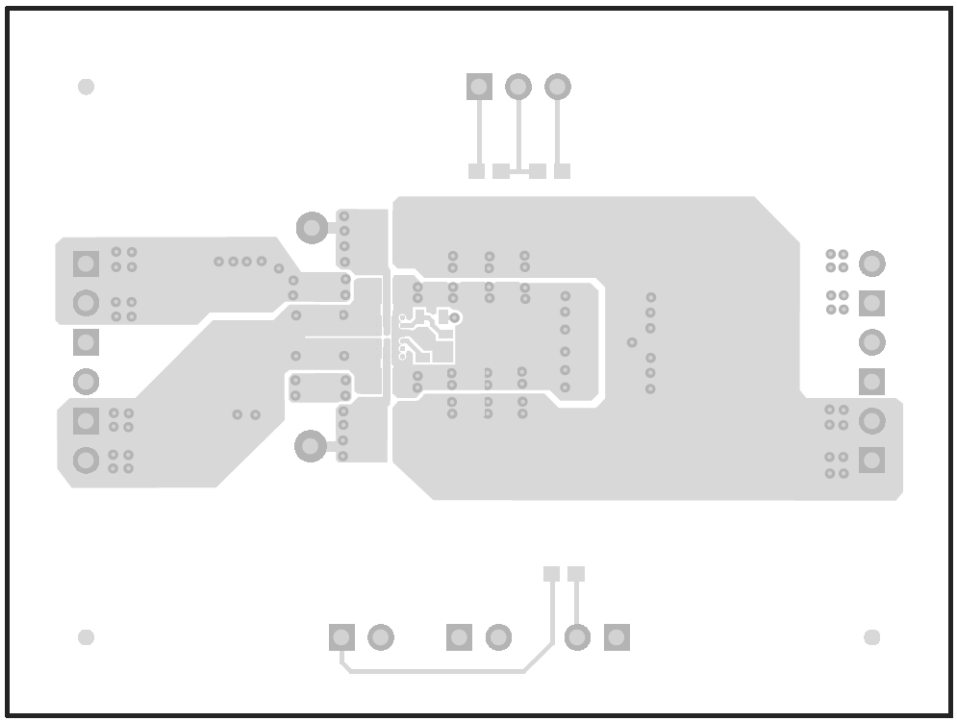

Figure 5. Top Layer

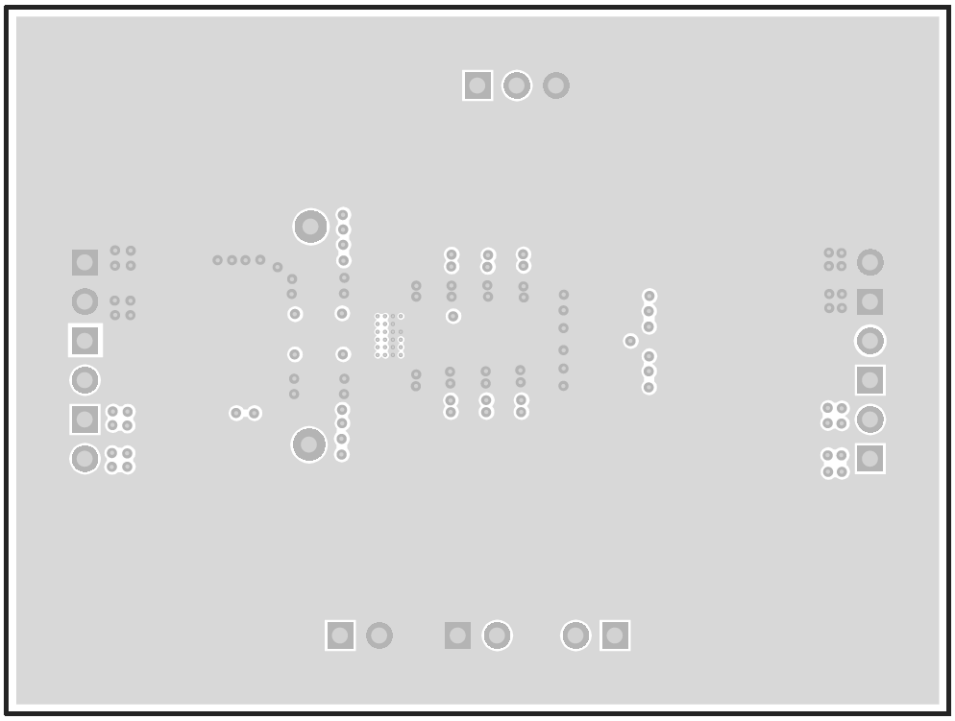

Figure 6. Internal Layer 1

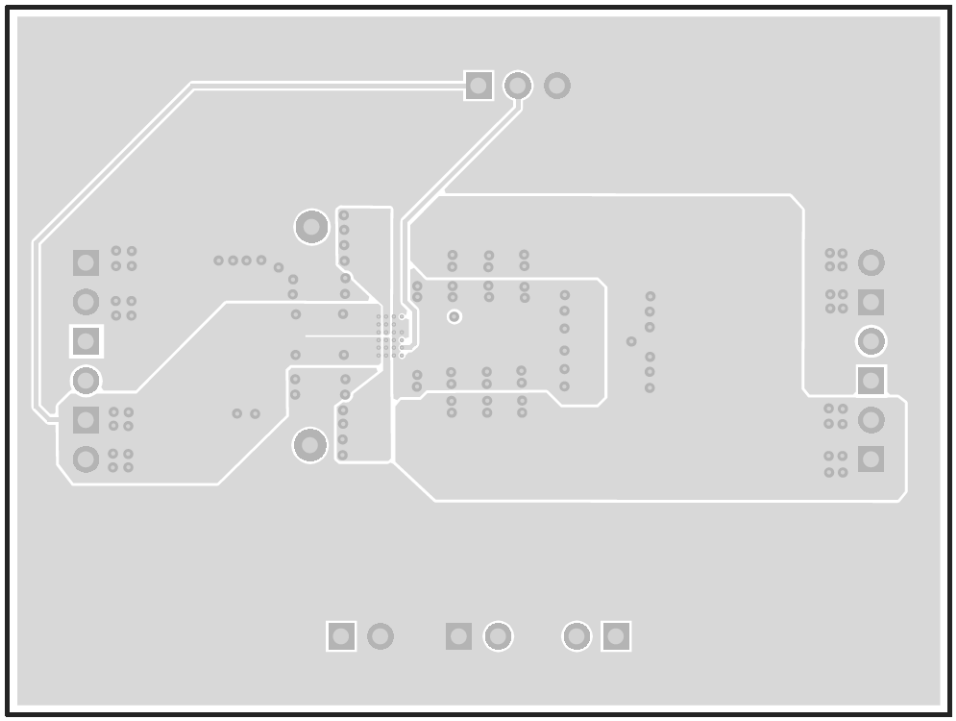

Figure 7. Internal Layer 2

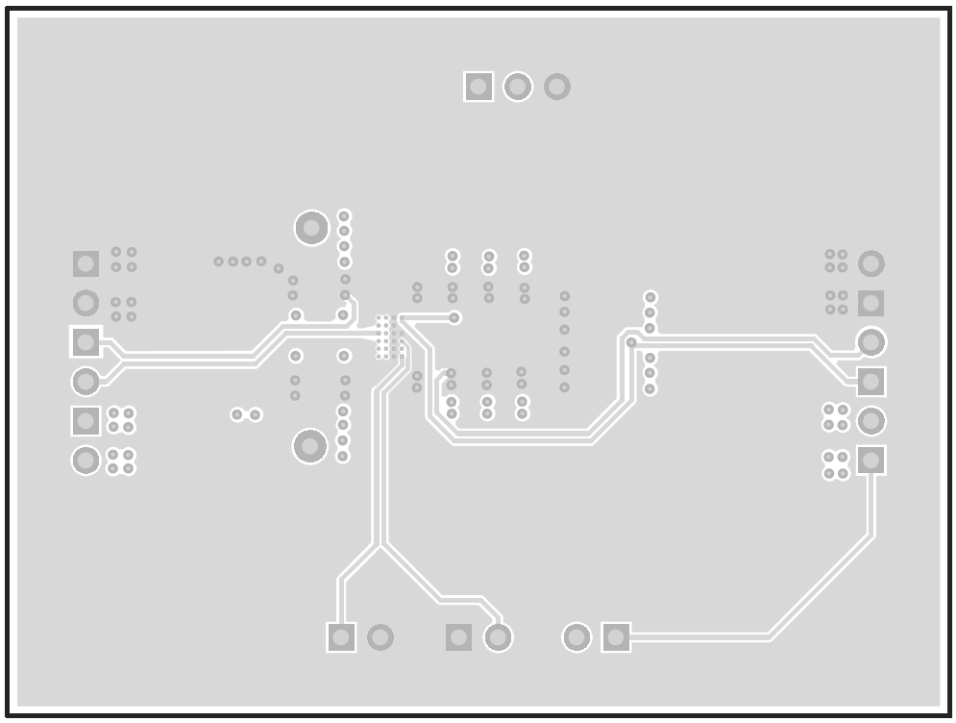

Figure 8. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS62180EVM-581 schematic and bill of materials.

5.1 Schematic

Figure 9 illustrates the TPS62180EVM-581 schematic.

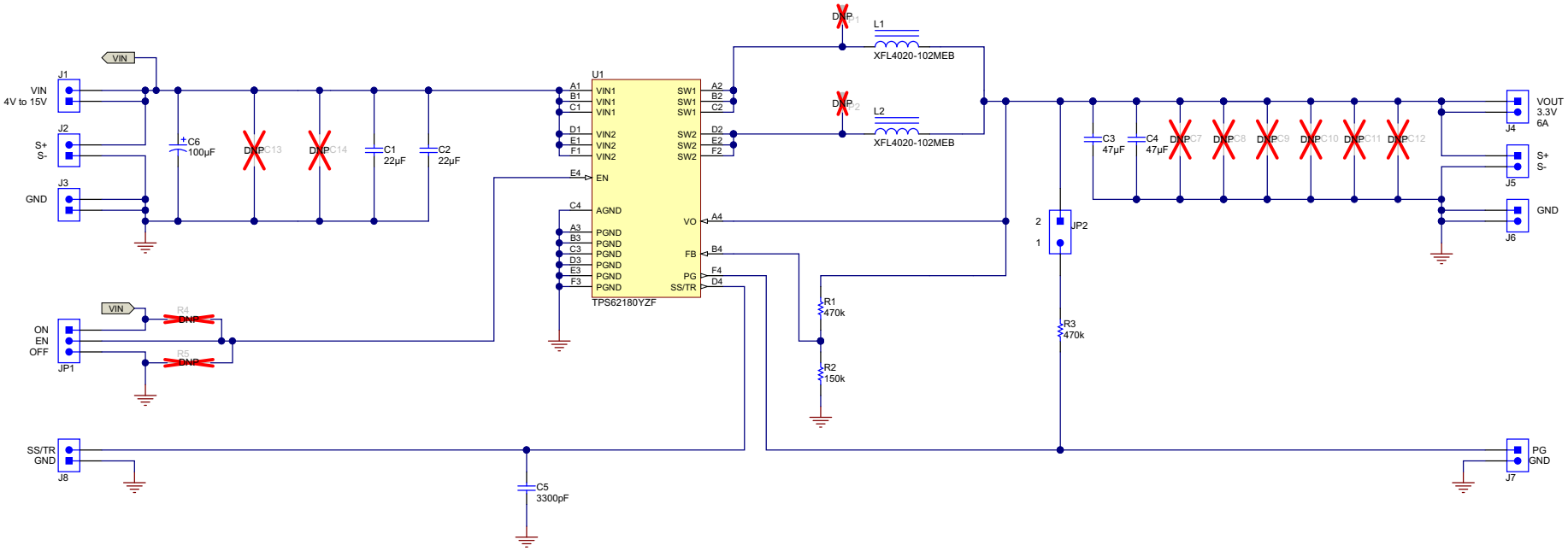

Figure 9. TPS62180EVM-581 Schematic

5.2 Bill of Materials

Table 2 lists the BOM for this EVM.

Table 2. TPS62180EVM-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, 5.4A, 0.01 ohm, SMD	4x2x4mm	XFL4020-102MEB	Coilcraft
2	R1, R3	470k	RES, 470k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07470KL	Yageo America
1	R2	150k	RES, 150k ohm, 1%, 0.1W, 0603	0603	RC0603FR-07150KL	Yageo America
1	U1	TPS62180(1)	4 - 15V, 6A, 2-Phase Step-Down Converter	2x3mm	TPS62180YZF	Texas Instruments

(1) The TPS62180EVM-581 may be populated with TPS62180 (U1) devices that do not contain the correct top-side markings on the top of the device itself. These devices are still fully-tested TPS62180 devices and meet the specified electrical characteristics of the data sheet.

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