

# TPS53124 Buck Controller Evaluation Module User's Guide



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### Trademarks

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## 1 Description

The TPS53124 is a dual, adaptive on-time D-CAP™ mode synchronous buck controller. The TPS53124 enables system designers to cost-effectively complete the suite of DTV POL regulators and digital STB regulators with a low external component count. The main control loop for the TPS53124 uses the D-CAP mode that is optimized for low-ESR output capacitors such as POSCAP, SP-CAP, or high polymer chemistry and provides fast transient response with no external compensation. The TPS53124 provides conversion voltages (drain voltage for the synchronous high-side MOSFET) from 4.5 V to 24 V and output voltages from 0.76 V to 5.5 V.

The HPA332 (TPS53124EVM) evaluation module is a high-efficiency, dual synchronous buck converter providing 1.05 V at 4 A and 1.8 V at 4 A from 5-V to 22-V input. This user's guide describes the HPA332 performance.

## 2 Electrical Performance

**Table 2-1. Electrical Performance**

SPECIFICATIONS		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage range (VIN)			5	12	22	V
CH1	Output voltage			1.05		V
	Operating frequency	$V_{IN} = 12\text{ V}, I_{out1} = 1\text{ A}$		280		kHz
	Output current			4		A
	Overcurrent limit	$V_{IN} = 12\text{ V}$		5		A
	Output ripple voltage	$V_{IN} = 12\text{ V}, I_{out1} = 4\text{ A}$			29	mVp-p
CH2	Output voltage			1.8		V
	Operating frequency	$V_{IN} = 12\text{ V}, I_{out2} = 1\text{ A}$		360		kHz
	Output current			4		A
	Overcurrent limit	$V_{IN} = 12\text{ V}$		5		A
	Output ripple voltage	$V_{IN} = 12\text{ V}, I_{out2} = 4\text{ A}$			33	mVp-p

### 3 Schematic

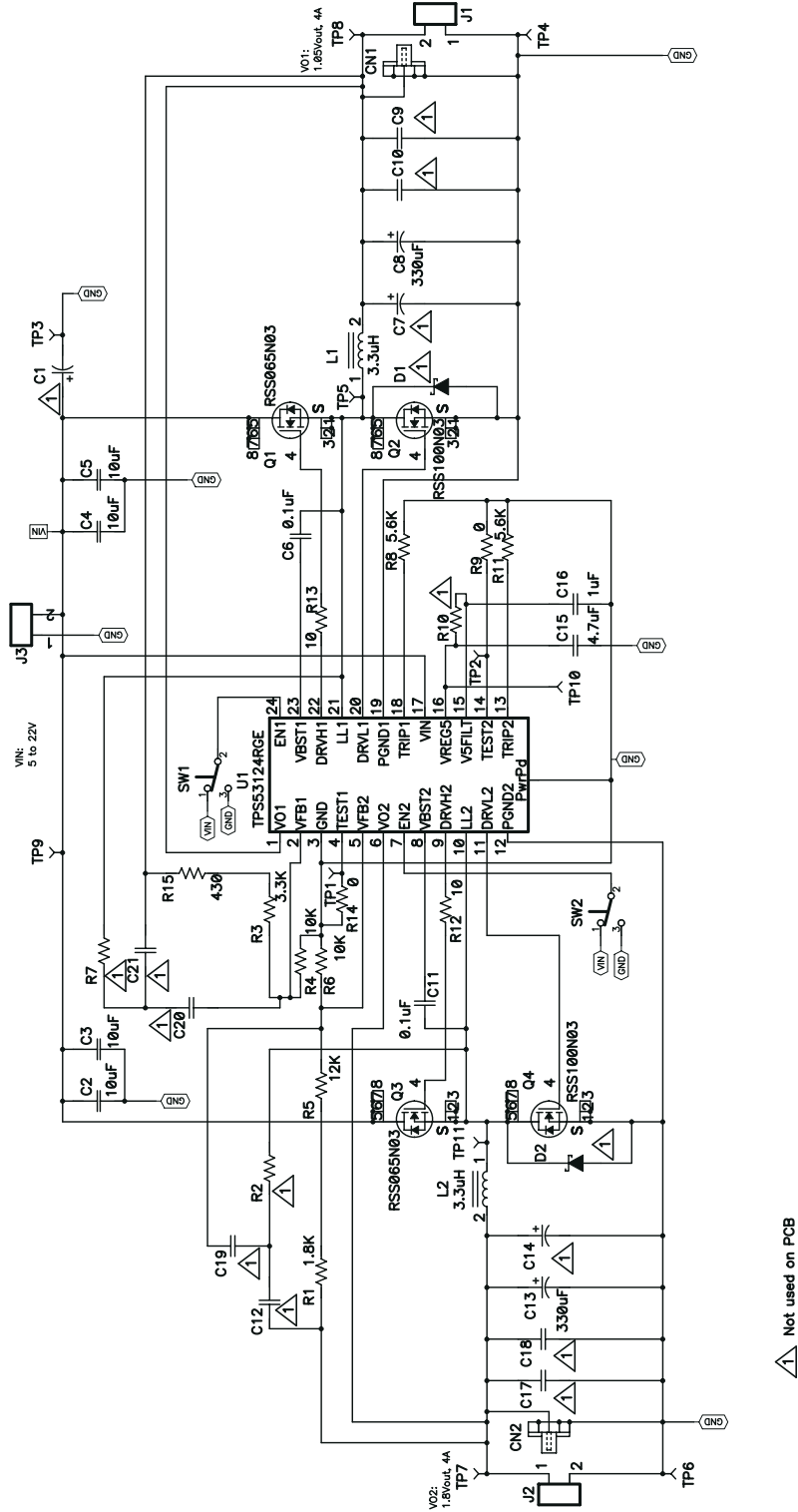


Figure 3-1. TPS53124 EVM Schematic Diagram

## 4 Test Setup and Results

### 4.1 Test Setup

Connect the test equipment and HPA332 EVM board as shown in Figure 4-1.

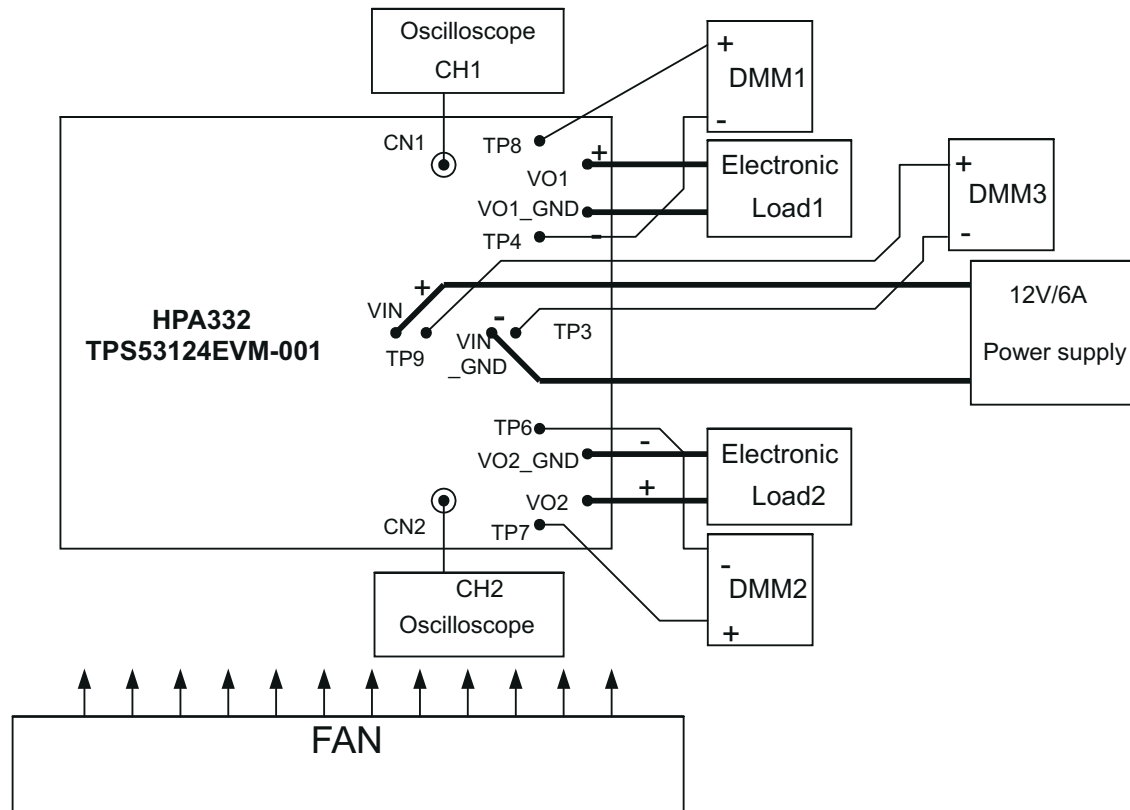


Figure 4-1. Equipment Setup for HPA332 EVM Board

### 4.2 Test Procedure

1. Make sure the switches SW1 (EN1) and SW2 (EN2) are in *OFF* position.
2. Apply appropriate VIN voltage to VIN and VIN\_GND terminals.
3. Turn on SW1 (EN1), CH1-output will start up.
4. Turn on SW2 (EN2), CH2-output will start up.

### 4.3 Start-Up Performance

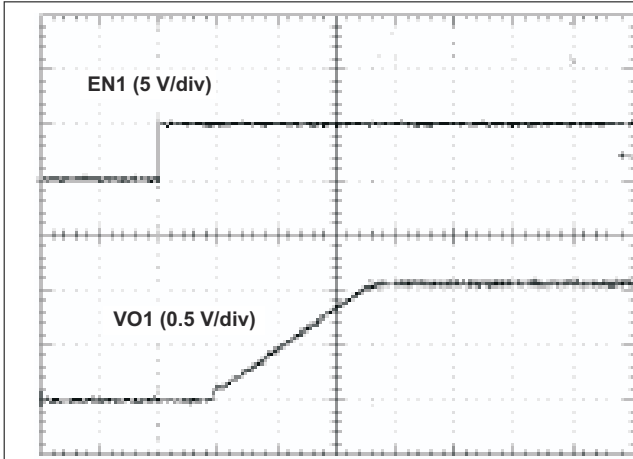


Figure 4-2. 1.05-V Start-Up Waveforms

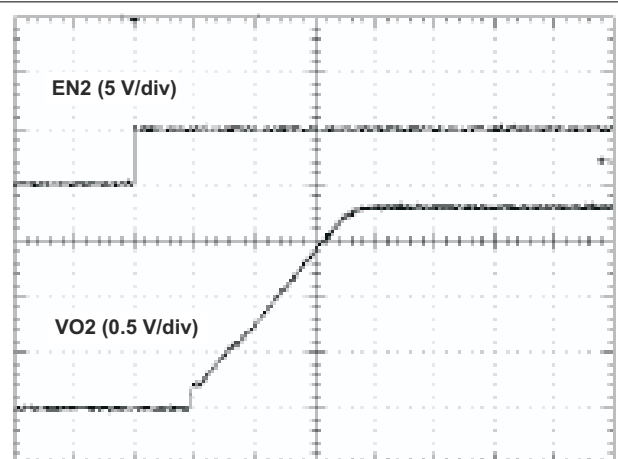


Figure 4-3. 1.8-V Start-Up Waveform

### 4.4 Transient Response

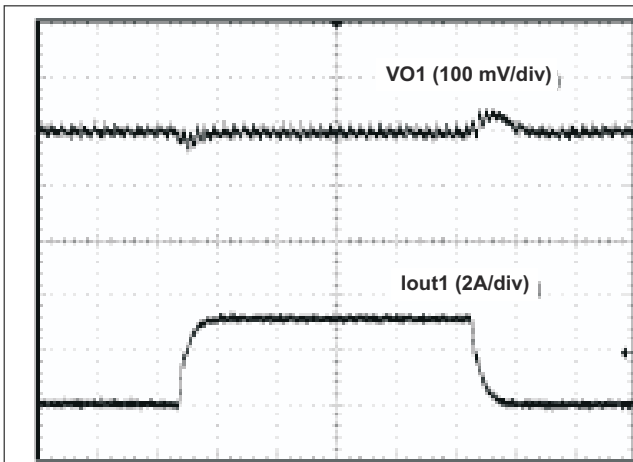


Figure 4-4. 1.05-V Load Transient Response

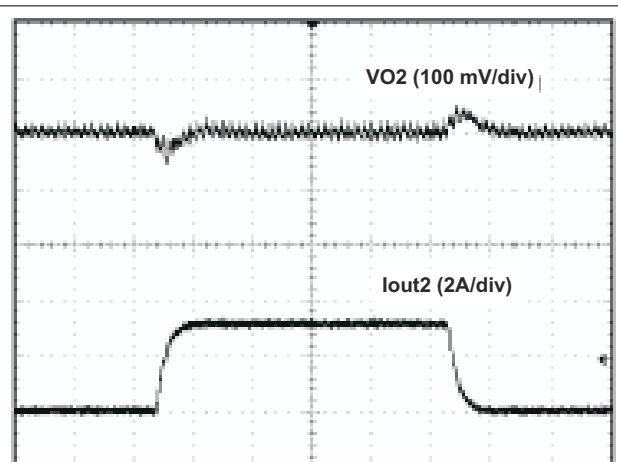


Figure 4-5. 1.8-V Load Transient Response

## 5 Configuration

This EVM can be set at desired configurations. Refer to the following specific setting configuration sections.

### 5.1 Bootstrap Diode Selection

Bootstrap diodes are not populated on this EVM since TPS53124 has them built-in. External Schottky diodes can be added to improve efficiency.

## 6 EVM Assembly Drawing and PCB Layout

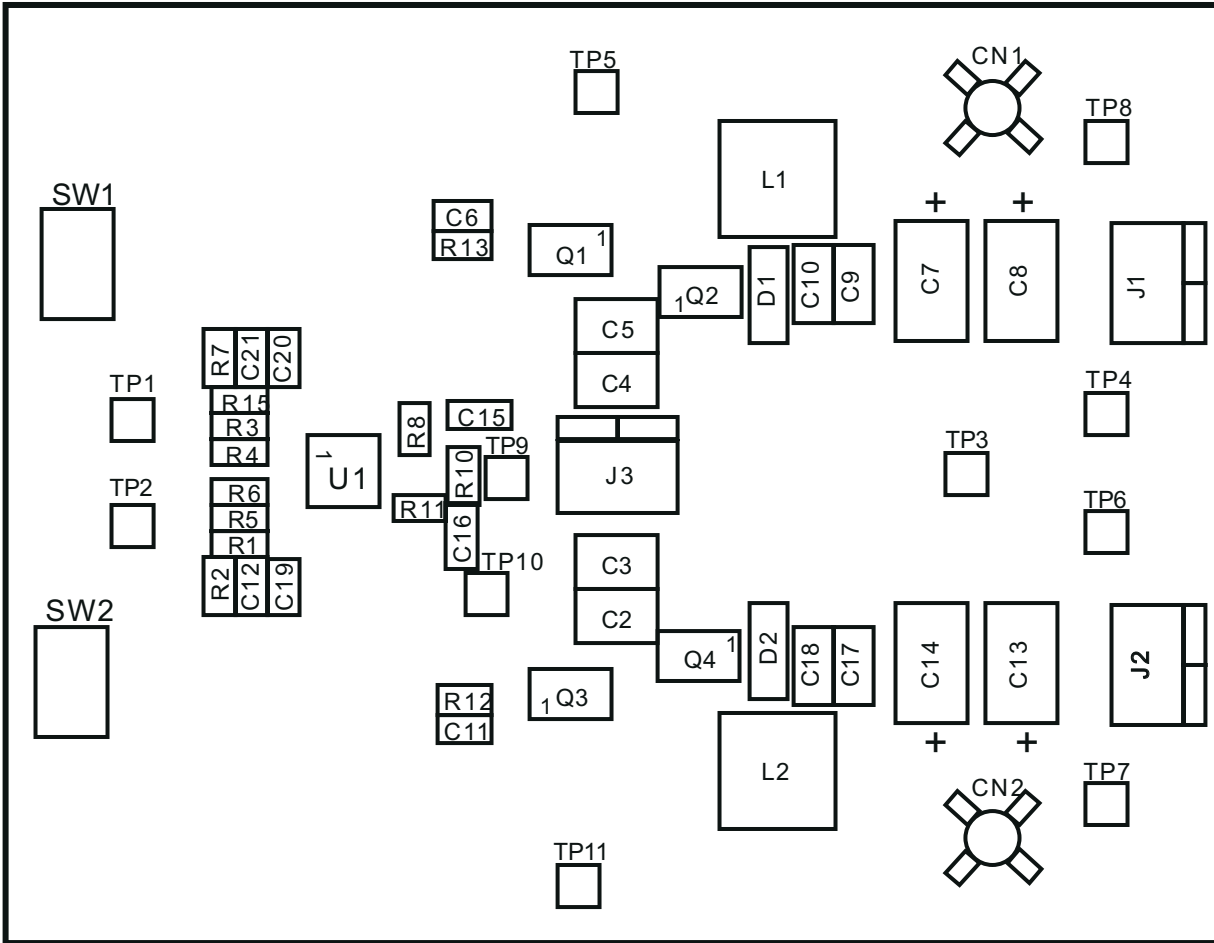


Figure 6-1. Top Assembly

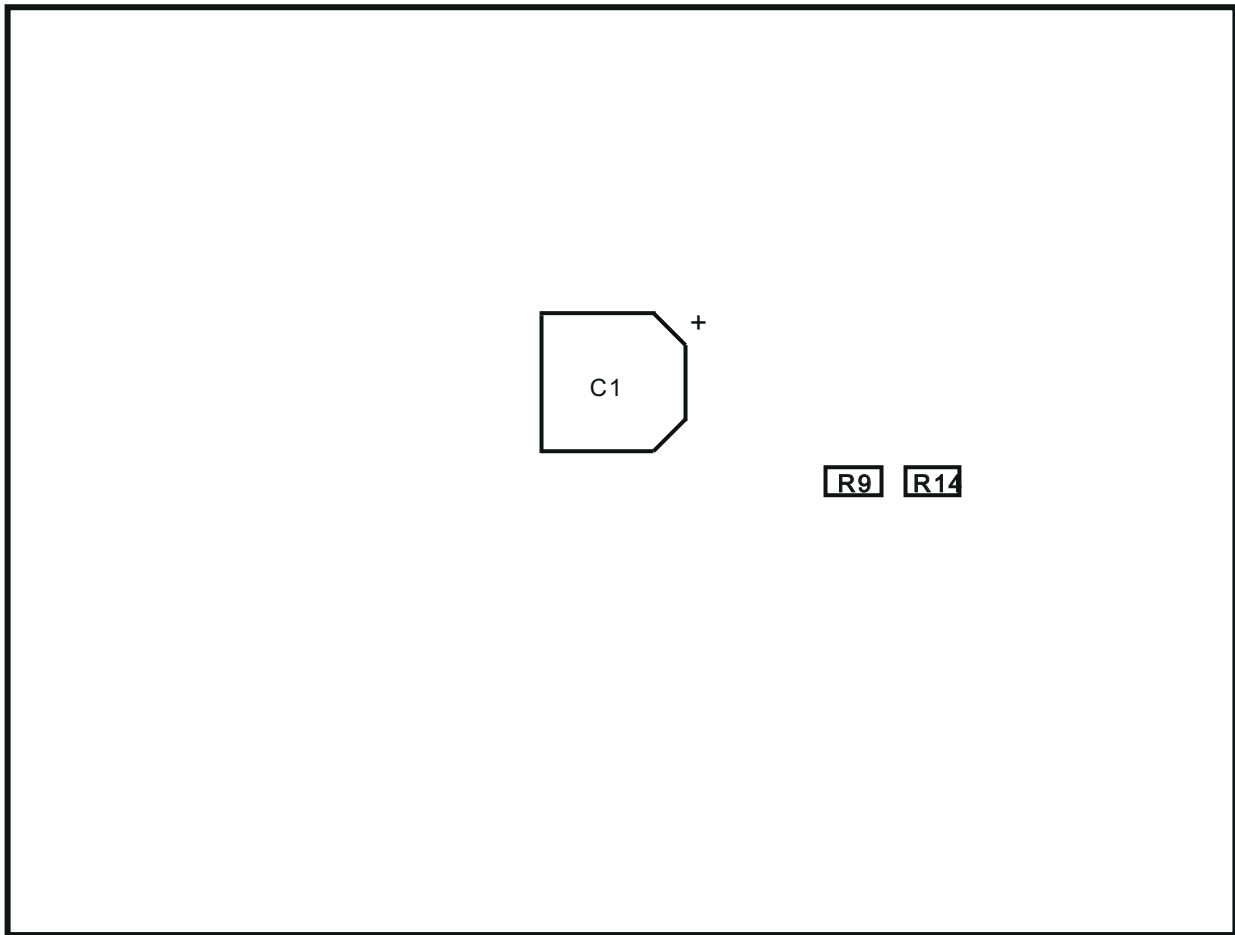


Figure 6-2. Bottom Assembly

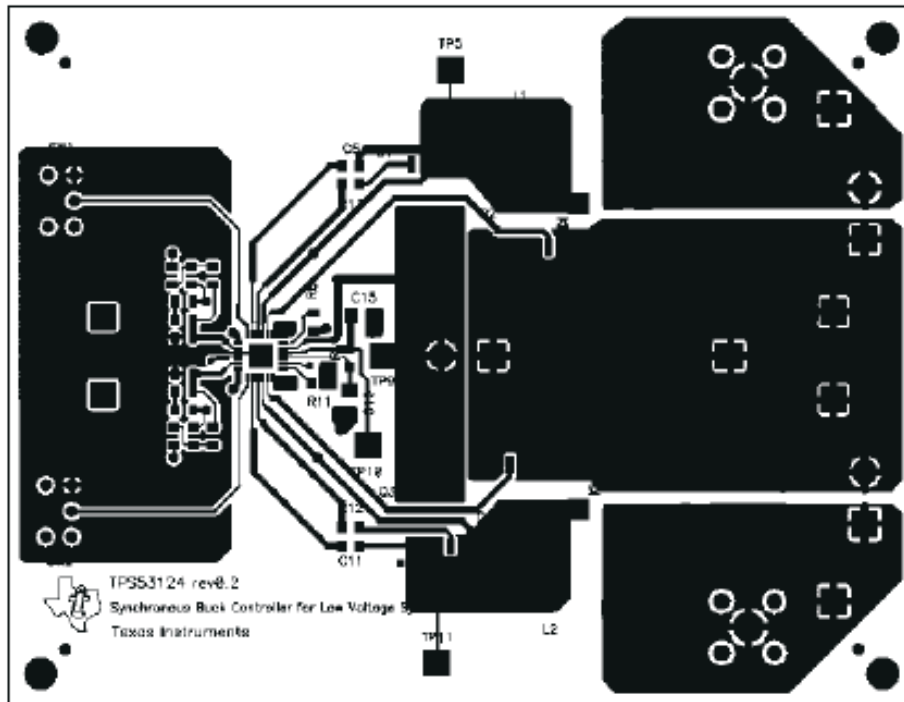


Figure 6-3. Top Layer

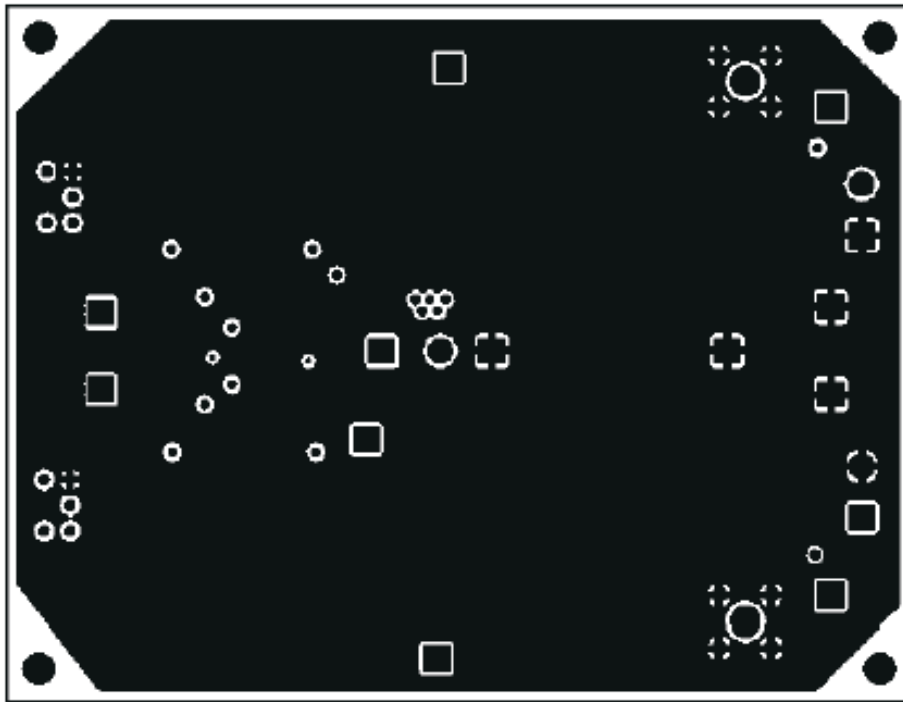


Figure 6-4. Inner Layer 1

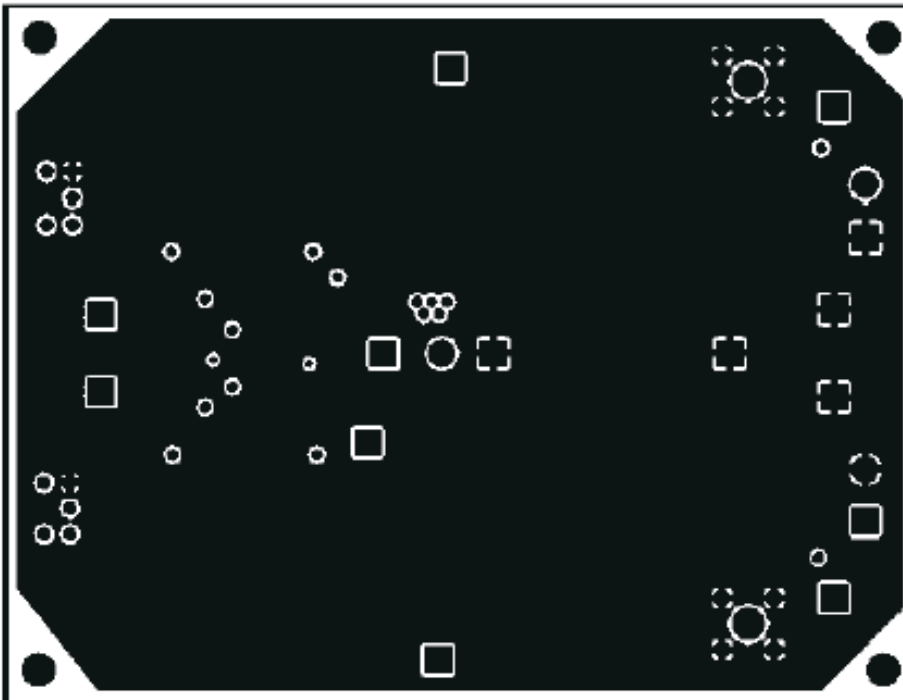
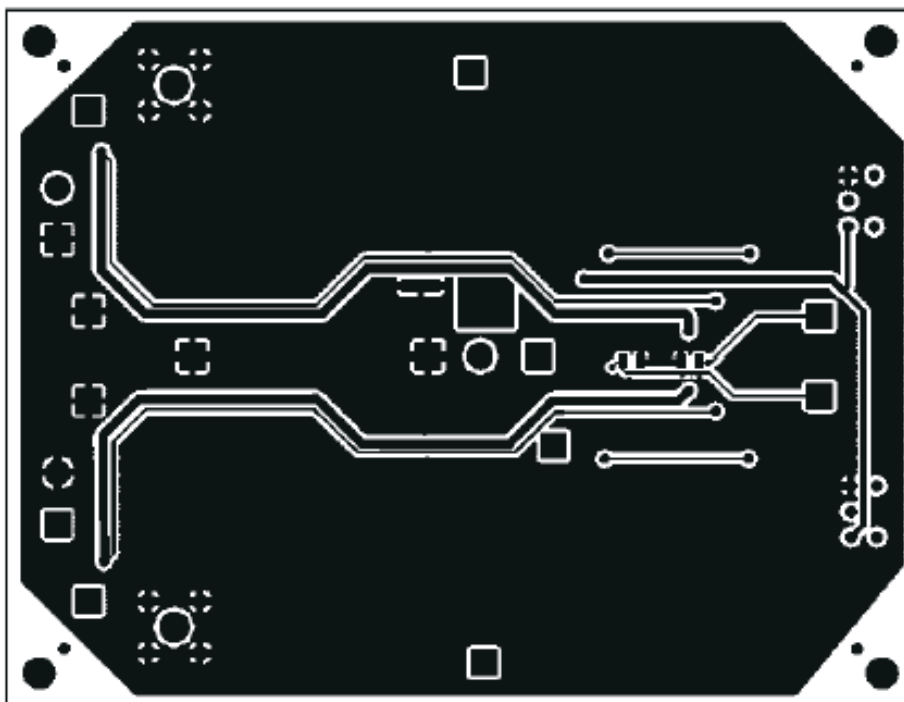


Figure 6-5. Inner Layer 2





**Figure 6-6. Bottom Layer**

## 7 List of Materials

**Table 7-1. List of Materials**

Ref Dsg	QTY	Description	Size	MFR	Part Number
C1	0	Capacitor, Aluminum	0.26 × 0.26 inch	Any	Any
C8, C13	2	Capacitor, NPCAP, 330 μF, 4.0-V 15-mΩ , 20%	6.6 × 7.2 mm	NIPPON CHEMICON	APXE4R0ARA331M
C15	1	Capacitor, Ceramic, 4.7 μF, 10-V, BJ, 20%	0805	TDK	C2012JB1A475MN
C16	1	Capacitor, Ceramic, 1 μF, 16-V, BJ, 20%	0805	TDK	C2012JB1C105M75MN
C2, C3, C4, C5	4	Capacitor, Ceramic, 10 μF, 25-V, BJ , 20%	1210	Taiyo Yuden	TMK325BJ106MN
C6, C11	2	Capacitor, Ceramic, 0.1 μF, 50-V, BJ, 20%	0603	Std	Std
C7,C14	0	not mount	6,6 × 7.2 mm	Any	Any
C9, C10, C17,C18	0	not mount	1206	Any	Any
C12 ,C19–C21	0	not mount	0603	Any	Any
CN1, CN2	0	Adaptor, 3,5-mm probe clip ( or 131-5031-00)	0.2	Tektronix	131-4244-001
D1, D2	0	Diode, Schottky, 1-A, 30-V	SMA	Any	Any
J1, J2, J3	3	Terminal Block, 2-pin, 15-A, 5,1mm	0.40 × 0.35 inch	Phoenix Contact	MKDSN1.5/2-5.08
L1, L2	2	Inductor, 3.3 μH, 6.0 A, 29.7 mΩ	6,5 × 7.1 mm	TDK	SPM6530T-3R3M
Q1, Q3	2	MOSFET, N-ch, 30-V, 6.5-A, 38-mΩ	SO8	ROHM	RSS065N032
Q2, Q4	2	MOSFET, N-ch, 30-V, 10-A, 17.5-mΩ	SO8	ROHM	RSS100N03
R1	1	Resistor, Chip, 1.8 kΩ , 1/16W, 1%	0603	Std	Std
R3	1	Resistor, Chip, 3.3 kΩ , 1/16W, 1%	0603	Std	Std
R4, R6	2	Resistor, Chip, 10 kΩ , 1/16W, 1%	0603	Std	Std
R5	1	Resistor, Chip, 12 kΩ , 1/16W, 1%	0603	Std	Std
R8, R11	2	Resistor, Chip, 5.6 kΩ , 1/16W, 1%	0603	Std	Std
R9, R14	2	Resistor, Chip, 0 Ω , 1/16W, 1%	0603	Std	Std
R12, R13	2	Resistor, Chip, 10 Ω , 1/16W, 1%	0603	Std	Std
R15	1	Resistor, Chip, 430 Ω , 1/16W, 1%	0603	Std	Std
R2, R7, R10	0	not mount	0603	Any	Any
SW1, SW2	2	Switch, ON-ON Mini Toggle	0.28 × 0.18 inch	Nikkai	G12AP
TP1, TP2, TP5, TP11	4	Test Point, White, Thru Hole	0.125 × 0.125 inch	Keystone	5012
TP10	1	Test Point, Orange, Thru Hole	0.125 × 0.125 inch	Keystone	5013
TP3, TP4, TP6	3	Test Point, Black, Thru Hole	0.125 × 0.125 inch	Keystone	5011
TP7, TP8	2	Test Point, Yellow, Thru Hole	0.125 × 0.125 inch	Keystone	5014
TP9	1	Test Point, Red, Thru Hole	0.125 × 0.125 inch	Keystone	5010
U1	1	IC, Dual Synchronous Step-Down Controller for Low Voltage Power Rails	QFN24	TI	TPS53124RGE

## 8 Reference

Texas Instruments, [Dual Synchronous Step-Down Controller for Low Voltage Power Rails](#) data sheet

## 9 Revision History

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

<b>Changes from Revision * (July 2008) to Revision A (January 2022)</b>	<b>Page</b>
• Updated the numbering format for tables, figures, and cross-references throughout the document. ....	<a href="#">2</a>
• Updated the user's guide title.....	<a href="#">2</a>

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Last updated 10/2025