User's Guide

TPS53124 Buck Controller Evaluation Module User's Guide

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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 V, I_{out1} = 1 A		280		kHz
	Output current			4		A
	Overcurrent limit	V_{IN} = 12 V		5		A
	Output ripple voltage	V_{IN} = 12 V, I_{out1} = 4 A		29		mVp-p
CH2	Output voltage			1.8		V
	Operating frequency	V_{IN} = 12 V, I_{out2} = 1 A		360		kHz
	Output current			4		A
	Overcurrent limit	V_{IN} = 12 V		5		A
	Output ripple voltage	V_{IN} = 12 V, I_{out2} = 4 A		33		mVp-p

3 Schematic

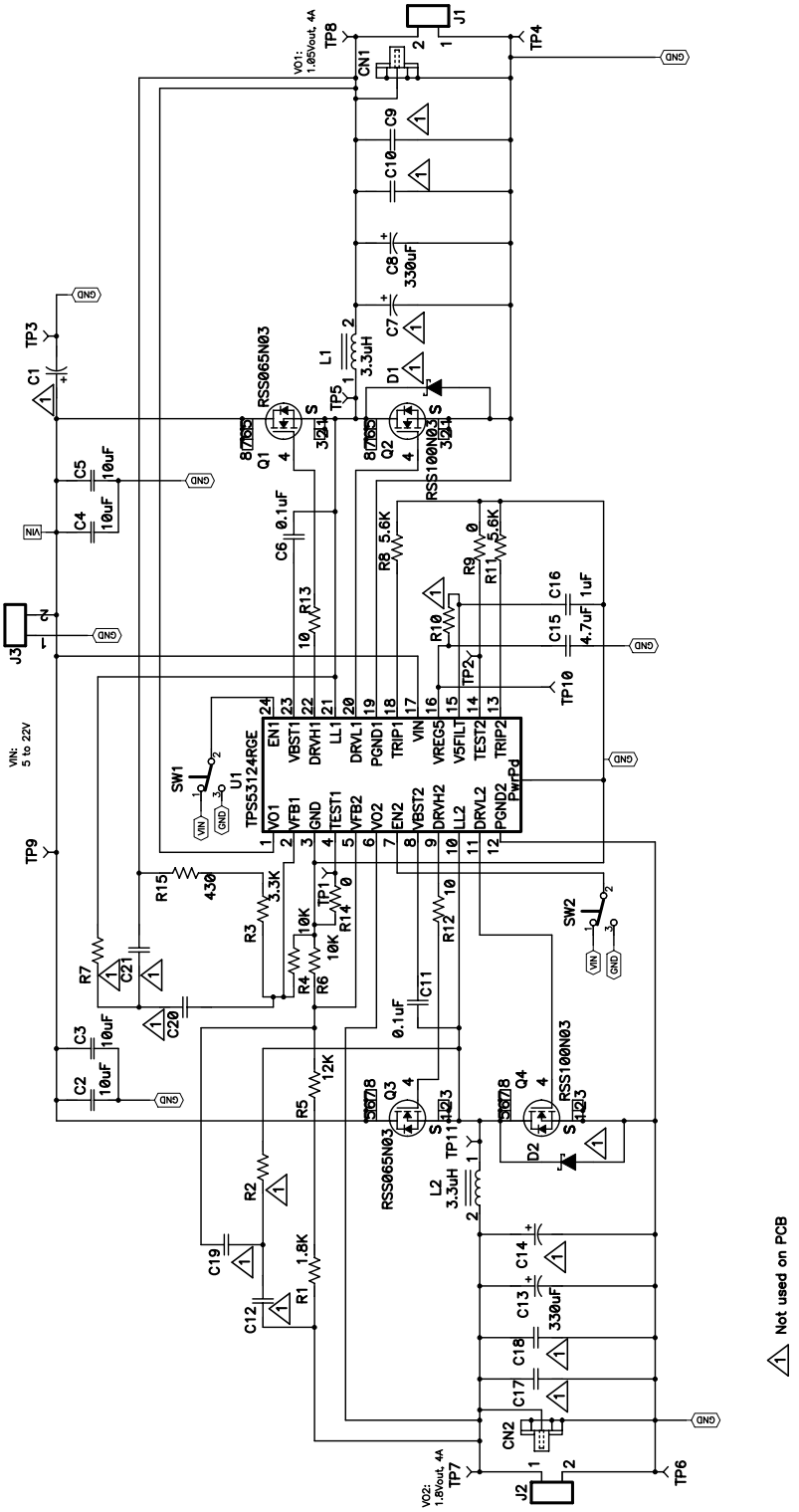

Figure 3-1. TPS53124 EVM Schematic Diagram

4 Test Setup and Results

4.1 Test Setup

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

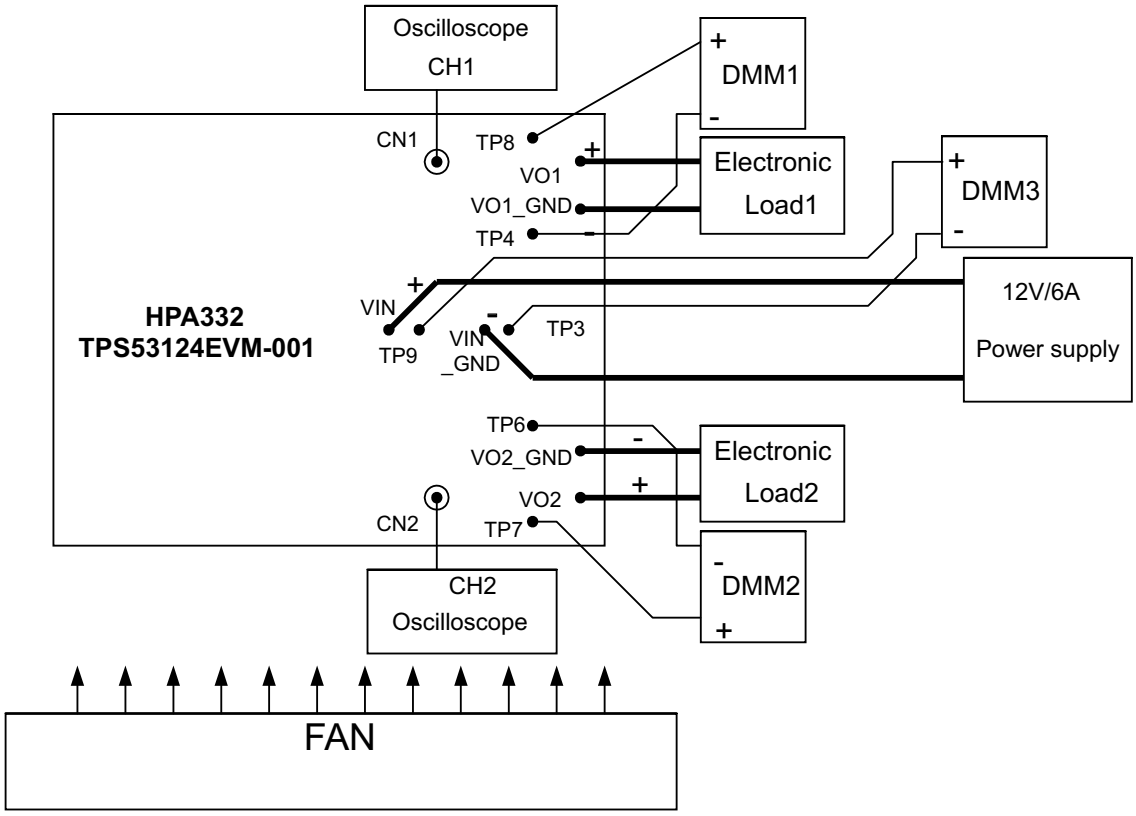

Figure 4-1. Equipment Setup for HPA332 EVM Board

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

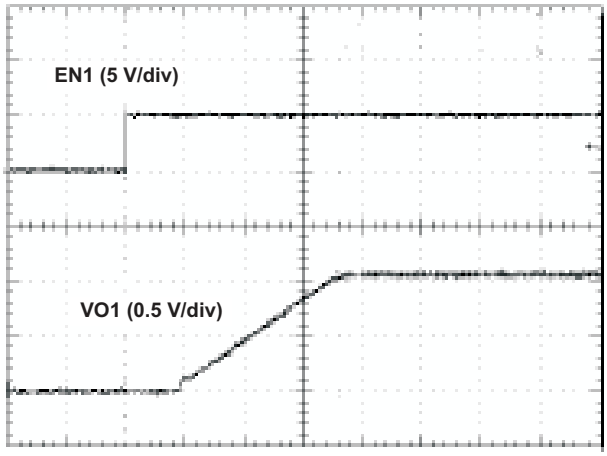

Figure 4-2. 1.05-V Start-Up Waveforms

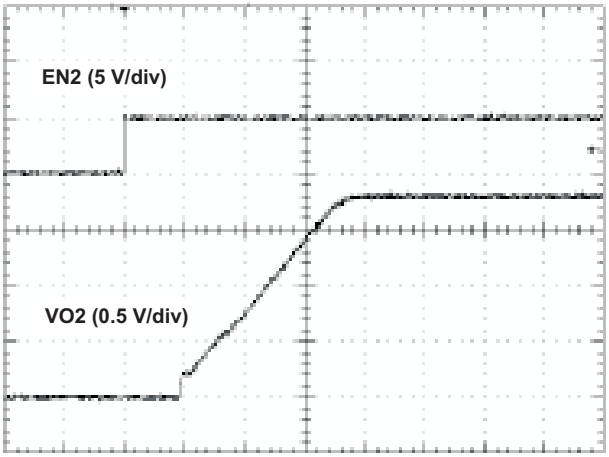

Figure 4-3. 1.8-V Start-Up Waveform

4.4 Transient Response

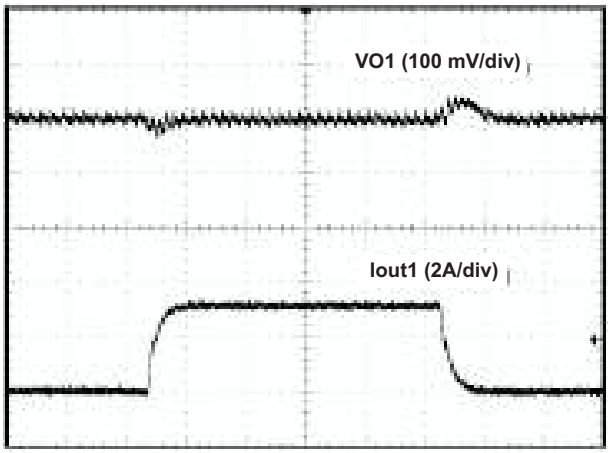

Figure 4-4. 1.05-V Load Transient Response

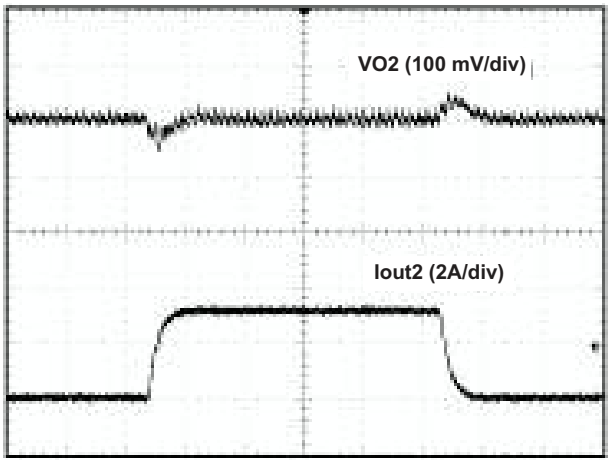

Figure 4-5. 1.8-V Load Transient Response

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

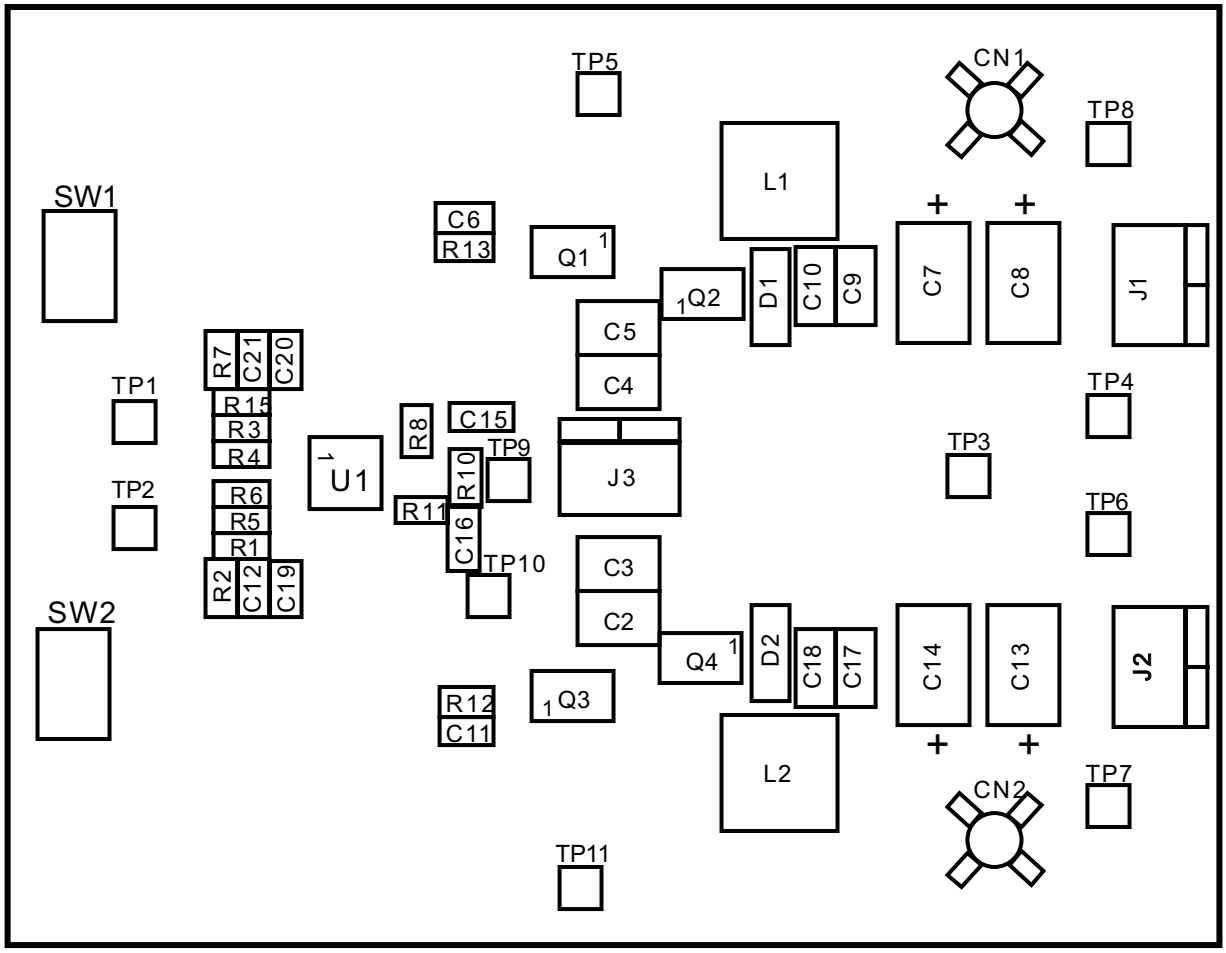

Figure 6-1. Top Assembly

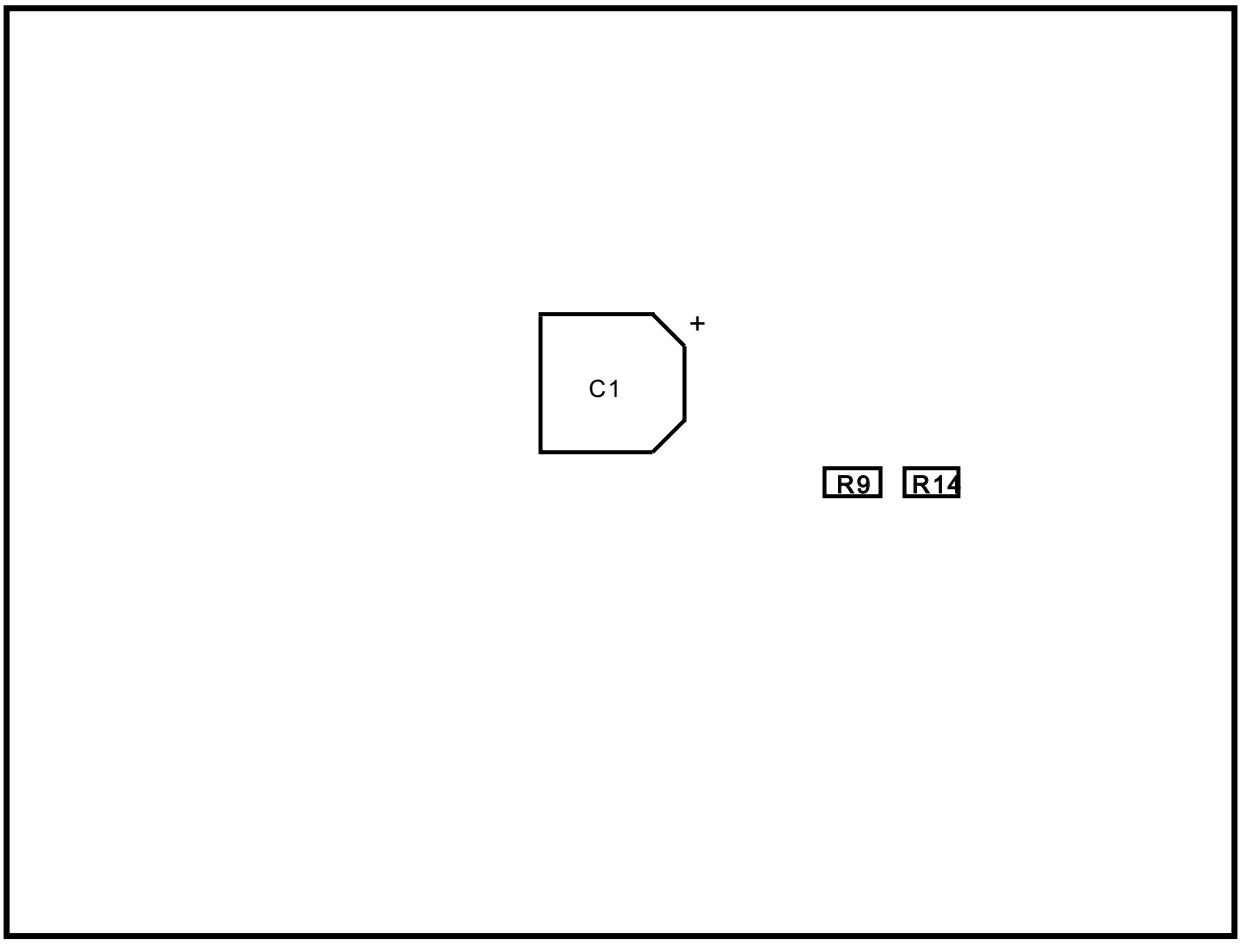

Figure 6-2. Bottom Assembly

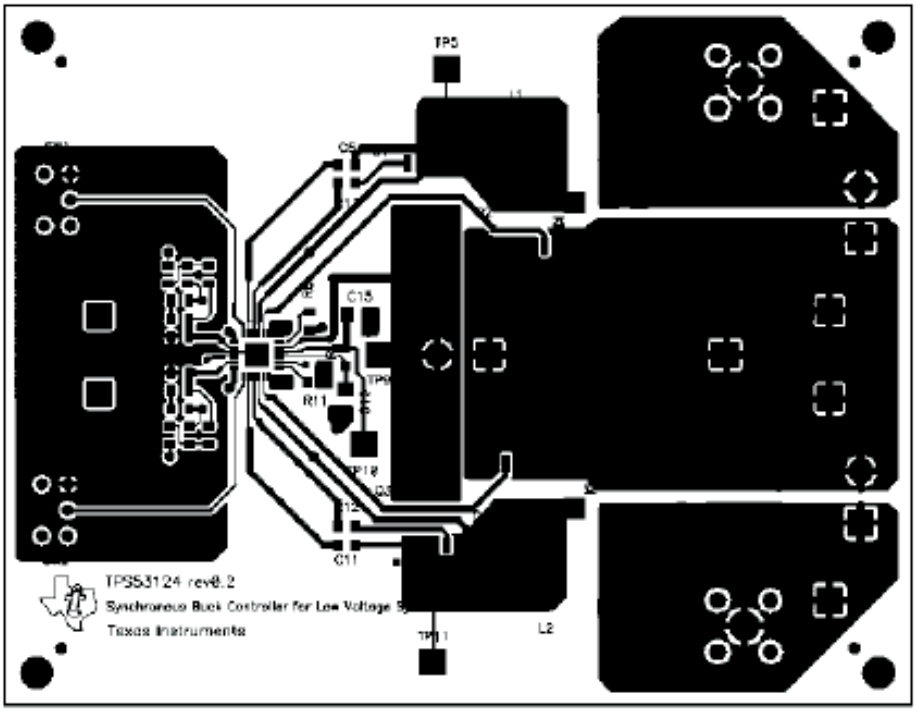

Figure 6-3. Top Layer

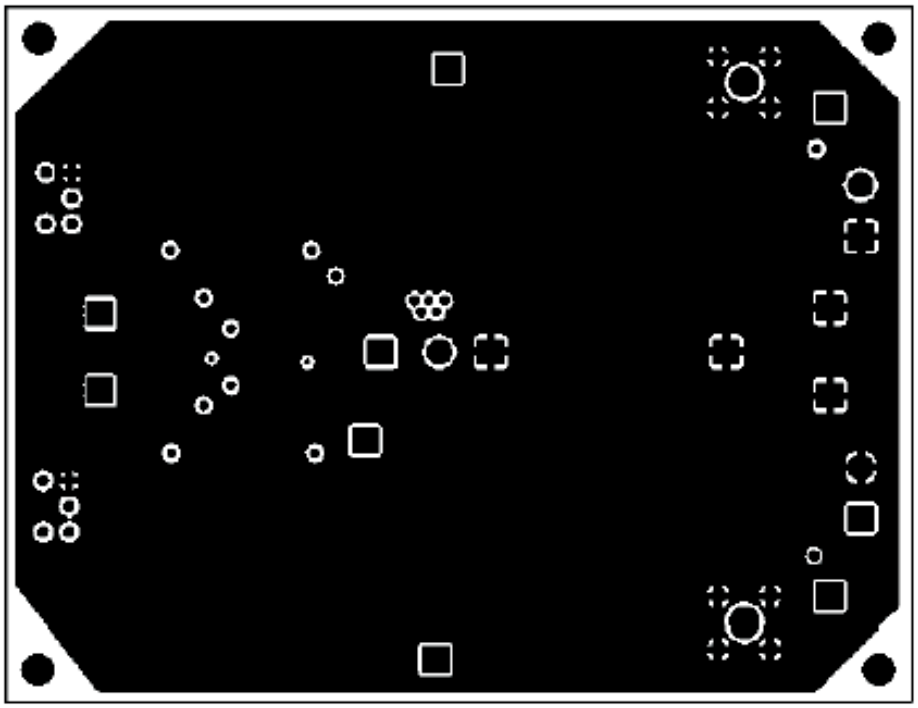

Figure 6-4. Inner Layer 1

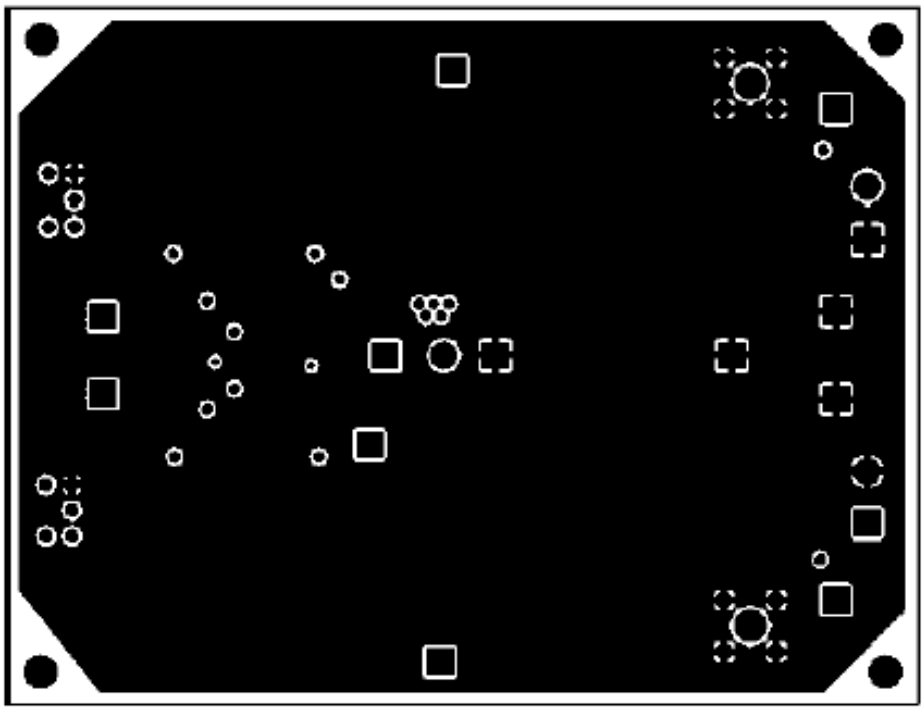

Figure 6-5. Inner Layer 2

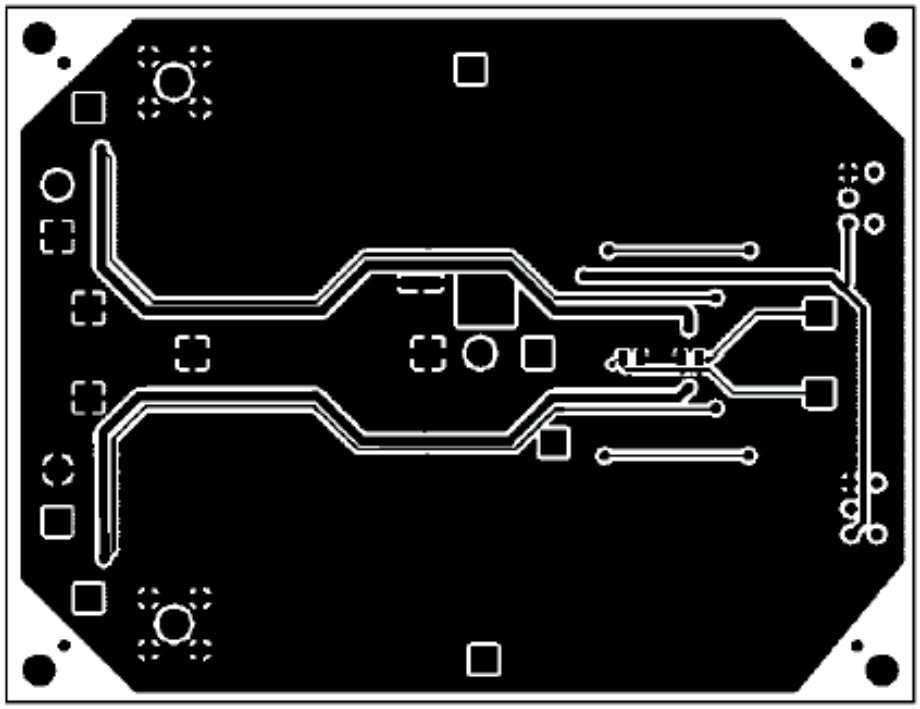

Figure 6-6. Bottom Layer

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.

Changes from Revision * (July 2008) to Revision A (January 2022)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.	2
• Updated the user's guide title.	2

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