High-Performance Synchronous Buck EVM Using the TPS51511

This user's guide contains information pertaining to the TPS51511 operating specification, the EVM schematic, the bill of materials, and the printed-circuit board layout.

1 Hardware

1.1 Operating Specification, TPS51511

Common Parameter

CH1: Switcher					
PARAMETER	**TEST CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
Input voltage range(VIN)		3		25	V
Input voltage range(V5IN)		4.75		5.25	V
Operating frequency			350		kHz
Output voltage	High performance		1.2	400k	V
	Low performance		1.1		
	Adjustable	0.75		3.3	
Output current			15		A
Current limit			18		A
CH2: LDO					
PARAMETER	**TEST CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
Input voltage range		1.5		5	V
Output voltage	VGA I/O power		1.2		V
	Adjustable	0.75		3.3	
Output current				2	A
Current limit			2.5		A

1.2 Schematic

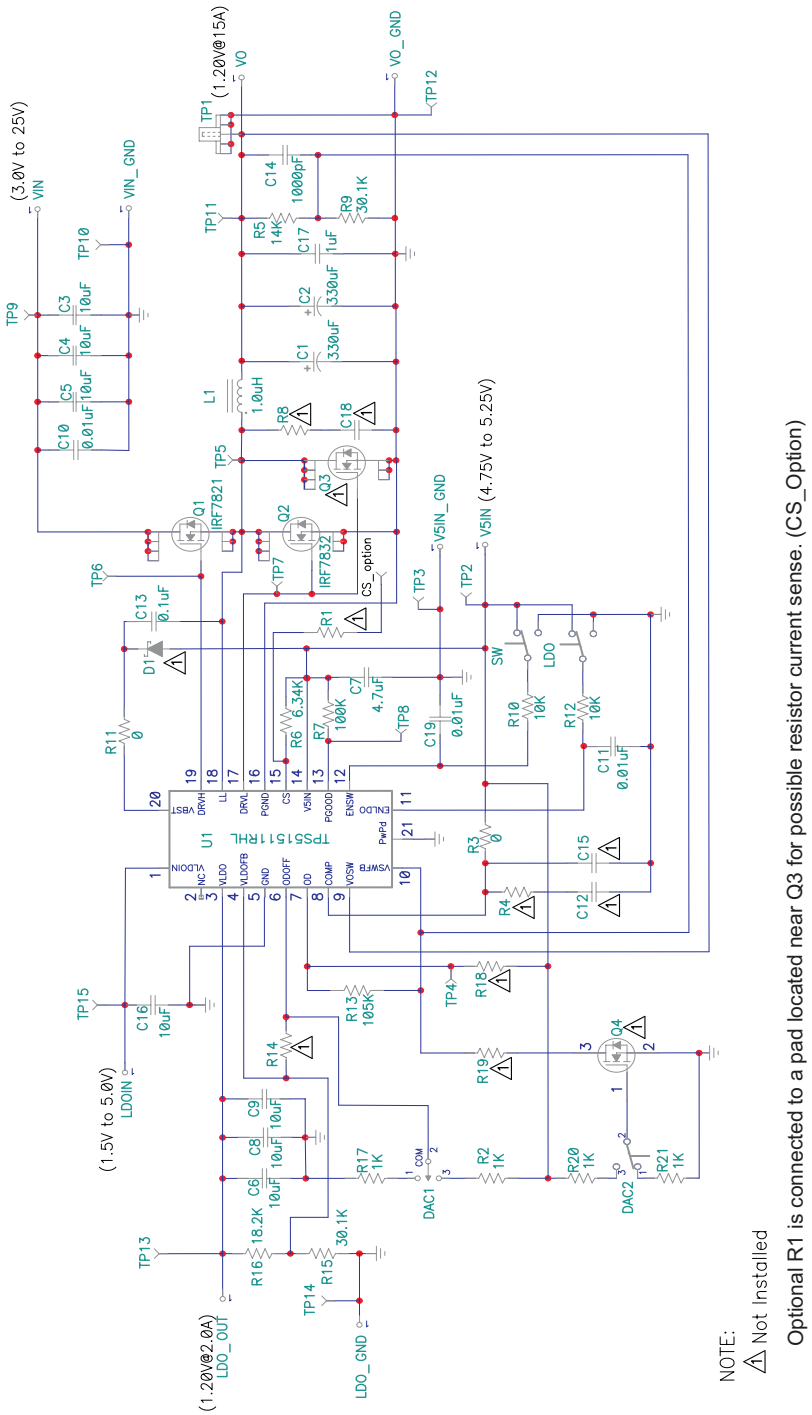

Figure 1. TPS51511RHL EVM Schematic Diagram (Switcher 1.2 V at 15 A, LDO 1.2 V at 2 A)

1.3 Bill of Materials

Table 1 presents The TPS51511EVM bill of materials.

Table 1. TPS51511EVM Bill of Materials

RefDes	Pattern Name	Value	MFR	Part Number
C1,C2	D2E	330 µF/2.5V	Sanyo	2R5TPE330MC
C3,C4,C5	1210	10 µF/25V	TDK	C3225X5R1E106M
C6,C8,C9,C16	0805	10 µF/6.3V	TDK	C2012X5R0J106K
C7	0603	4.7 µF/6.3V	TDK	C1608X5R0J475M
C10, C11, C19	0603	0.01 µF/50V	TDK	C1608X7R1H103M
C13	0603	0.1 µF/50V	TDK	C1608X7R1H104K
C14	0603	1000 pF /50V	TDK	C1608X7R1H102K
C17	0805	1 µF/ 25V	TDK	C2012X7R1E105K
C18	0603	Not Installed	TDK	C1608JB1H102M (1nF/50V)
C12,C15	0805	Not Installed	TDK	C1608X5R0JxxxM
Q1	SO-8	IRF7821	IR	IRF7821
Q2	SO-8	IRF7832	IR	IRF7832
Q3	SO-8	Not Installed	IR	IRF7832
Q4	SOT-23	Not Installed	Vishay	2N7002
D2	SOD-123	Not Installed	On Semi	MBR0530
L1	IND_IHLP- 5050	1.0 µH	Vishay	IHLP5050CEER1R0M01
DAC1	ON-OFF-ON	G-13AP	NKK	G13AP
DAC2, LDO, SW	ON-ON	G-12AP	NKK	G12AP
R3	0603	0	Vishay	Std
R11	0805	0	Vishay	Std
R2,R17,R20,R21	0603	1K	Vishay	Std
R6	0603	6.34K	Vishay	Std
R10, R12	0603	10K	Vishay	Std
R5	0603	14K	Vishay	Std
R16	0603	18.2K	Vishay	Std
R9, R15	0603	30.1K	Vishay	Std
R7	0603	100K	Vishay	Std
R13	0603	105K	Vishay	Std
R1,R14	0603	Not Installed	Vishay	0
R18	0603	Not Installed	Vishay	100K
R19	0603	Not Installed	Vishay	Depends on 2bit DAC Vout set
R4	0603	Not Installed	Vishay	Std
R8	0805	Not Installed	Vishay	Std
U1	QFN 20	TPS51511	TI	TPS51511RHL
TP1	TP-Probe	131-4244-00	Tektronix	131-4244-00
TP2–TP15	TP loop	5002	Keystone Elect.	50021
V5IN,V5IN_GND,VIN,VIN_GND, VO,VO_GND, LDOIN,LDO_GND,LDO_OUT	Turret Dbl	1582-2	Keystone Elect.	1582-2
HARDWARE				
Standoff	SJ5003	Bumpon 0.44×0.20 Black (4Corners bottom)	3M	SJ5003 (Black)

1.4 Board Layout Using TPS51511RHL (QFN 20)

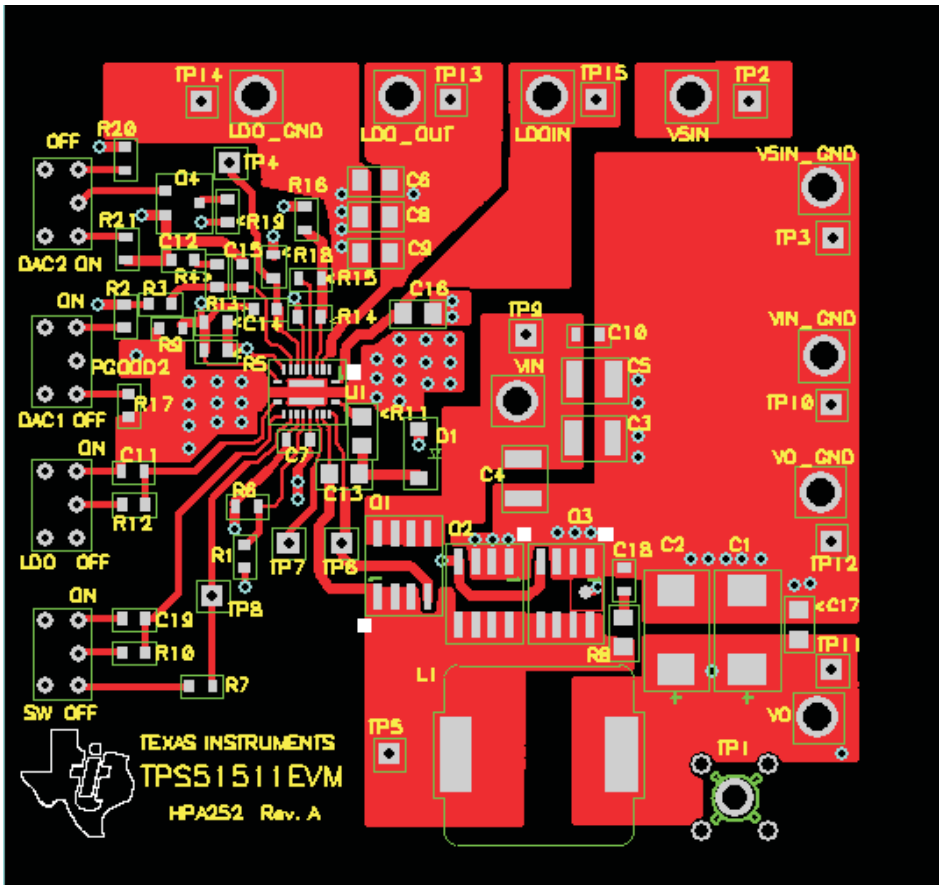

Figure 2. Top Layer Copper

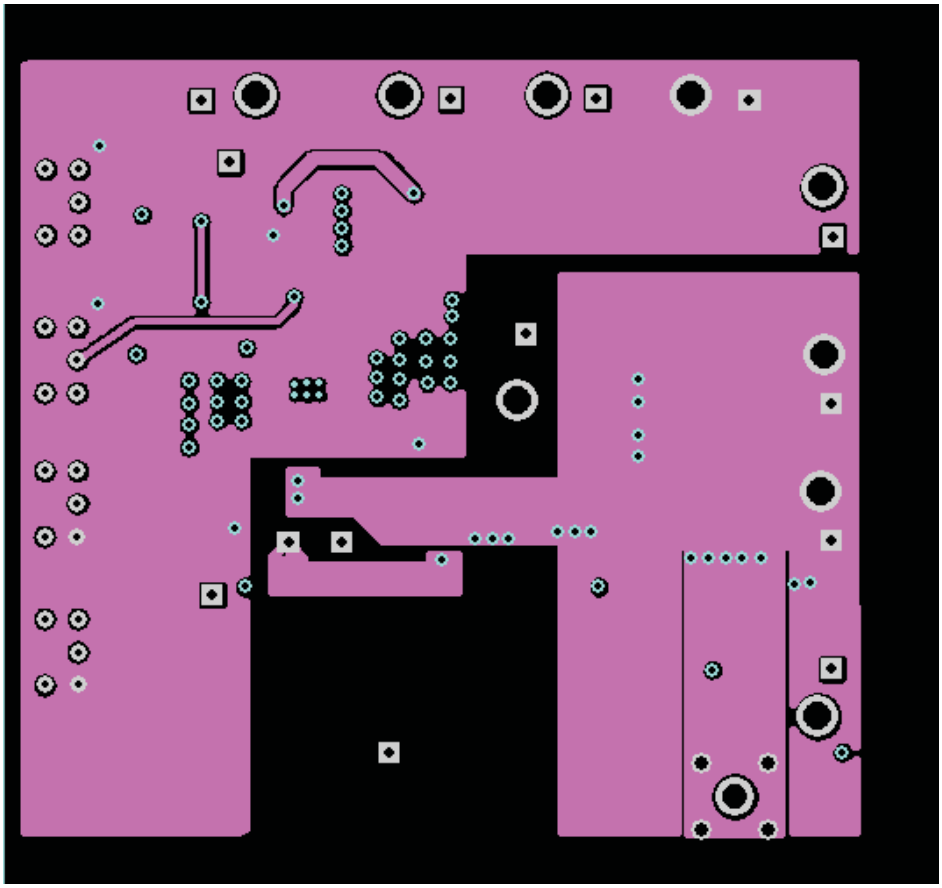

Figure 3. Layer 2 (Internal 1) Copper

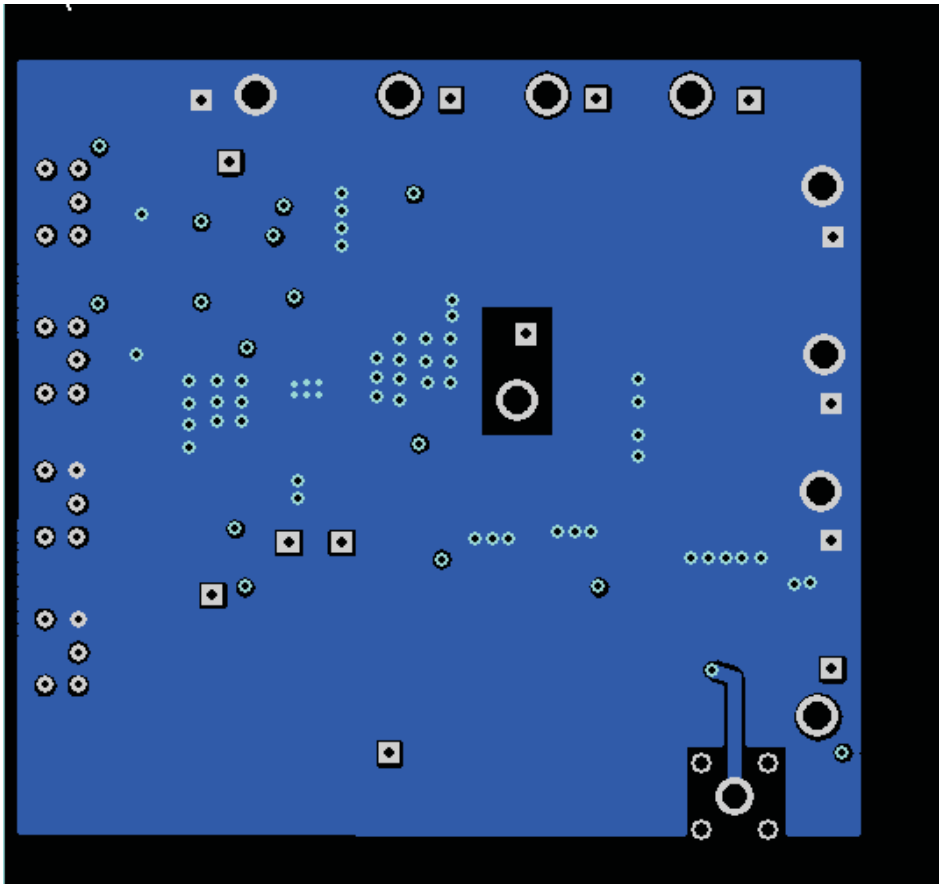

Figure 4. Layer 3 (Internal 2) Copper

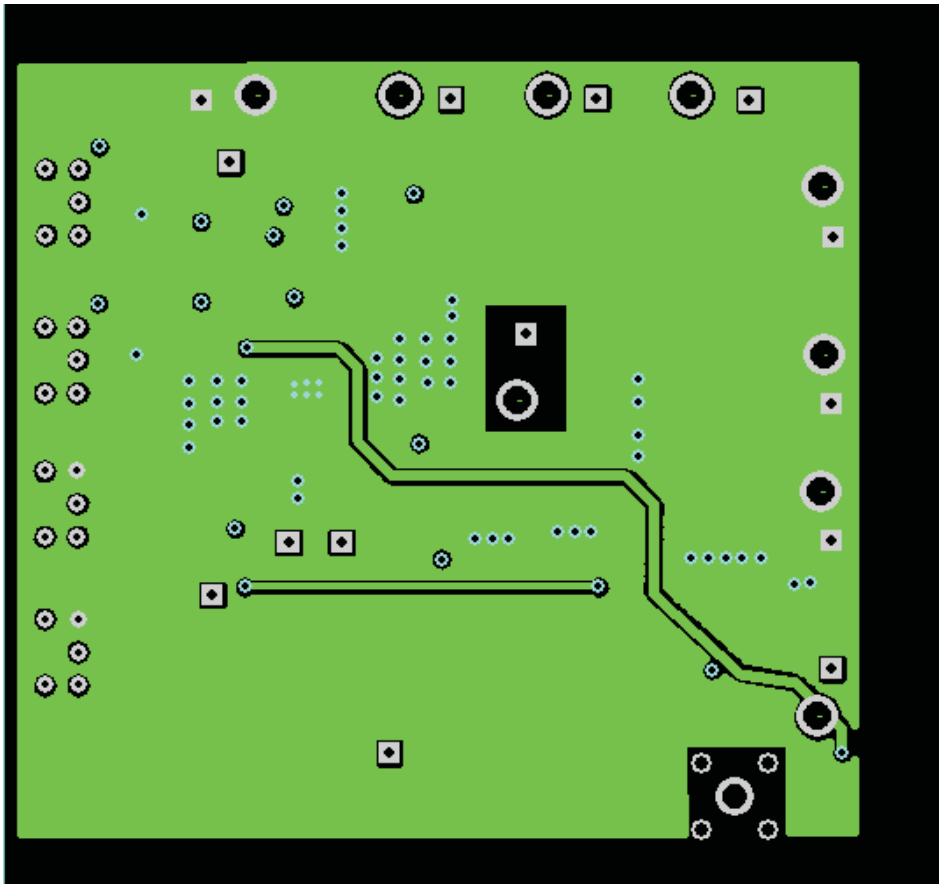

Figure 5. Bottom Layer Copper

1.5 Test Setup and Procedures

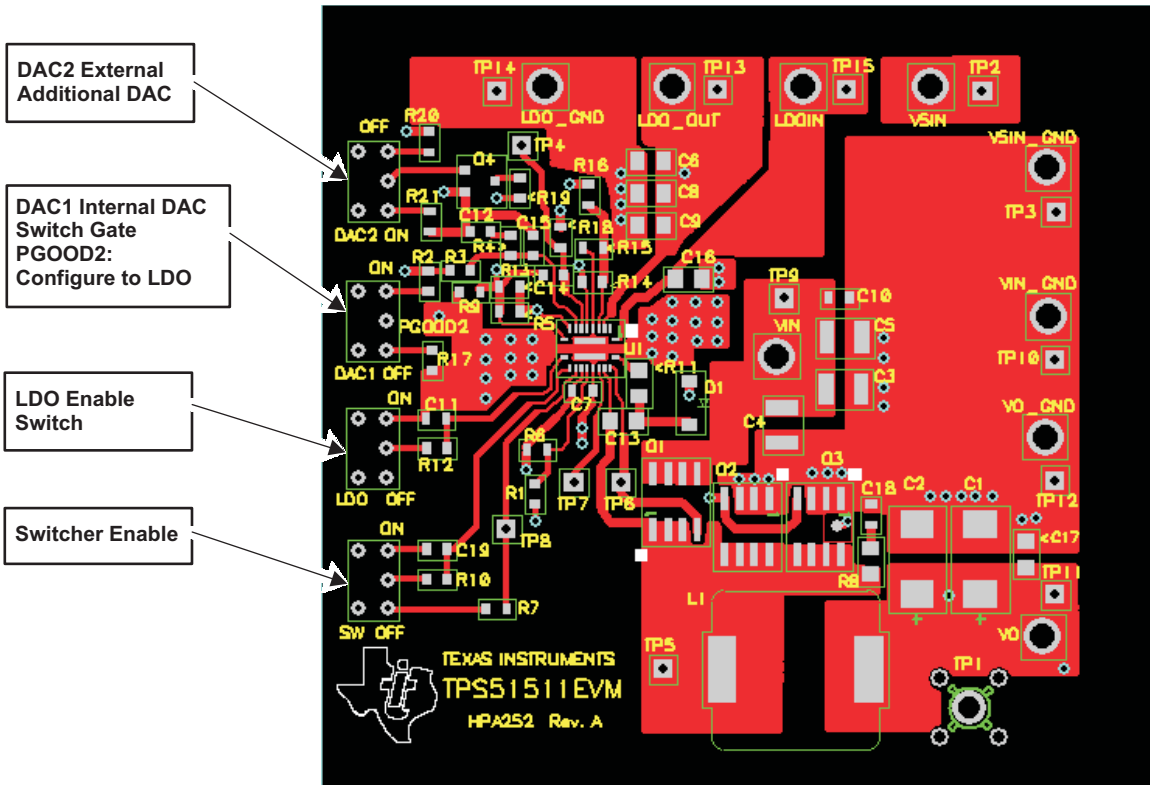

Figure 6. Switches and Jumpers

Table 2. Various Switch Settings

Switch	Function			
	On	Off	Floating	Components to Add for Specific Configuration
DAC2	Low	High	N/A	R19, Q4
DAC1	High	Low	LDO Power Good	R14, R18 (LDO Power Good)
LDO Switch	High	Low	N/A	N/A
Sw (Switcher Enable)	High	Low	N/A	N/A

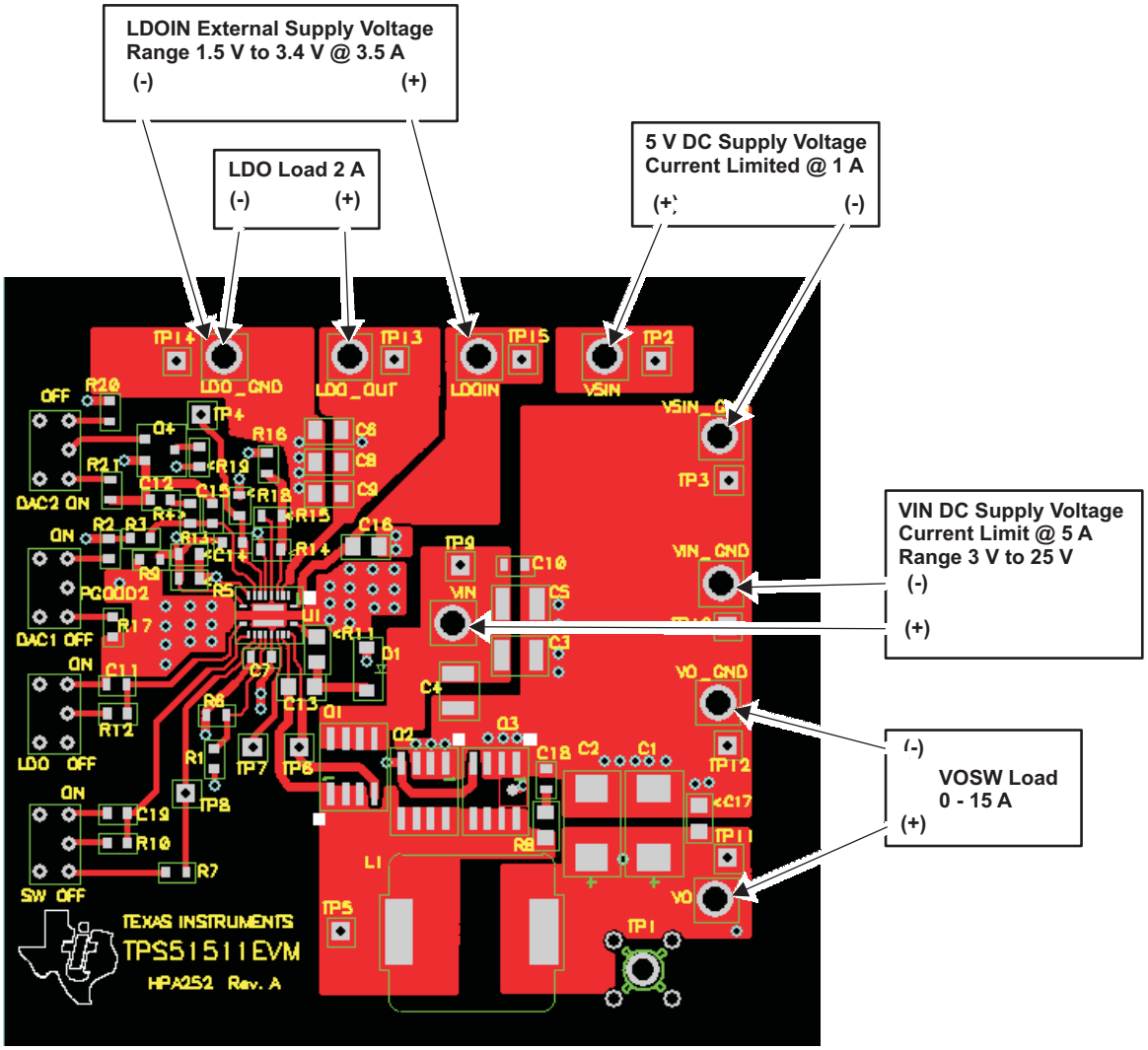

Figure 7. Test Setup

- **Standard Test Procedures**
  - *Required Equipment:*
    - 3 x Bench power supplies (V5in supply 4.75 V to 5.25 V at 1 A), (Vin supply 3 V to 25 V at 5 A), (LDO_IN 1.5 V to 3.4 V at 3.5 A).
    - 2 x Electronic loads one capable of sinking 19 A at 1.2 V and the other capable of sinking 4 A at 1.2 V.
  - *Switch Settings:*
    - DAC1 = ON, Switcher operates in the high-performance range (1.2-V output).
    - LDO (ON/OFF) = Enables or disables the LDO output (1.2 V at 2 A).
    - SW (ON/OFF) = Enables or disables the Switcher output. (1.2 V at 15 A) (Low-current skip mode current >2 A operates in PWM mode.
  - *Bootstrap Diode:*
    - Bootstrap diode D1 is not populated on the current evaluation module because the TPS51511 has a built-in bootstrap diode. In order to further improve the efficiency, D1 can be added.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 6 V to 21 V and the output voltage range of 0.75 V to 5.5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 100°C. The EVM is designed to operate properly with certain components above 100°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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