AN-1529 LM3430 Evaluation Board

1 Specifications of the Board

The Evaluation Board has been designed for testing of various circuits using the LM3430 boost regulator controller. A complete schematic for all the components is shown in Figure 1. The board is two layers with components and power paths in 1oz. copper. The board is 62mil FR4 laminate.

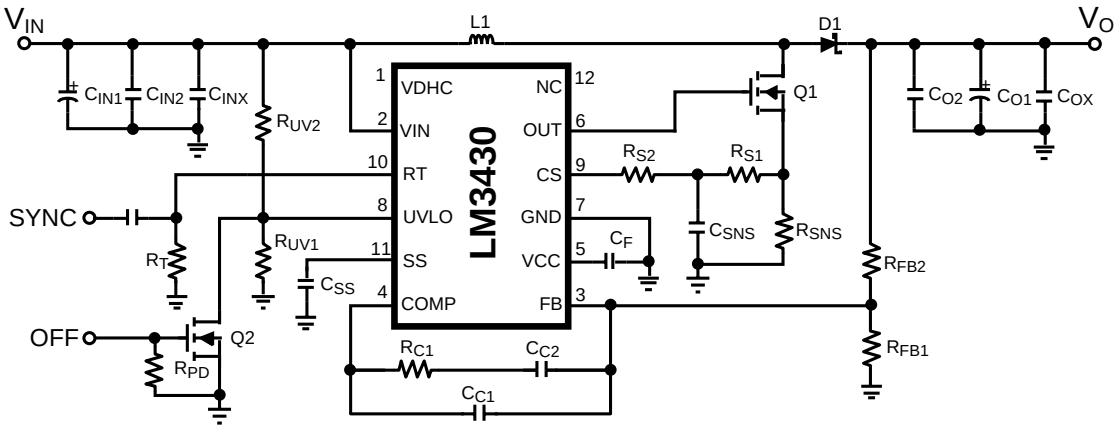


Figure 1. Circuit Schematic

2 Example Circuit

The example circuit that comes on the evaluation board delivers a 48V ±2% output voltage at currents up to 700 mA and switches at 600 kHz. The input voltage range is optimized between 10.8V and 26.4V. The measured efficiency of the converter is 96% at an input voltage of 24V and an output current of 0.7A.

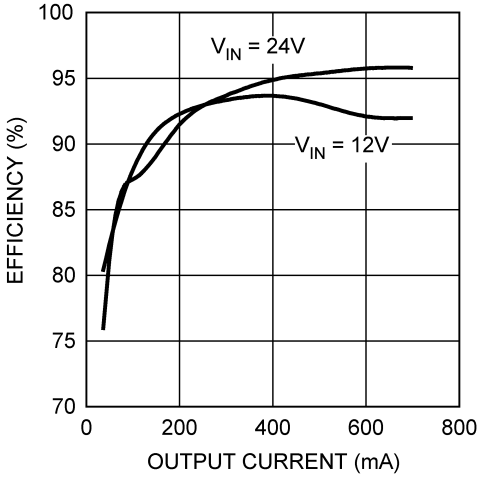


Figure 2. Efficiency

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3 Powering the Converter

The example circuit for the LM3430 Evaluation Board is optimized to run at inputs of 12V or 24V, however the circuit will operate with input voltages ranging from 6.0V to 40.0V connected between the 'VIN' and 'GND' terminals on the right side of the board. Fixed loads, resistors, and variable electronic loads can be connected between the 'Vo' and 'GND' terminals on the left side of the board. Section 10 lists all the components used in the example circuit.

4 Enabling the Converter

The OFF terminal controls the state of the converter while power is applied to the input terminals. The LM340 is disabled whenever the voltage at OFF is a logic high. (Above 2.0V.) The LM3430 is enabled whenever the OFF terminal is open-circuited or connected to ground. Upon enabling the LM3430 will perform a soft-start, after which the output is ready to supply current to the load.

5 Testing the Converter

Figure 3 shows a block diagram of connections for making measurements of efficiency. The wires used for making connections at both the input and output should be rated to at least 10A of continuous current and should be no longer than is needed for convenient testing. A series ammeter capable of measuring 10A or more should be used for both the input and the output lines. Dedicated voltmeters should be connected with their positive and negative leads right at the four power terminals at the sides of the evaluation board. This measurement technique minimizes the resistive loss in the wires that connect the evaluation board to the input power supply and the electronic load.

Output voltage ripple measurements should be taken directly across the 100 nF ceramic capacitor Cox, placed right between the output terminals. Care must be taken to minimize the loop area between the oscilloscope probe tip and the ground lead. One method to minimize this loop is to remove the probe's spring tip and 'pigtail' ground lead and then wind bare wire around the probe shaft. The bare wire should contact the ground of the probe, and the end of the wire can then contact the ground side of Cox. Figure 4 shows a diagram of this method.

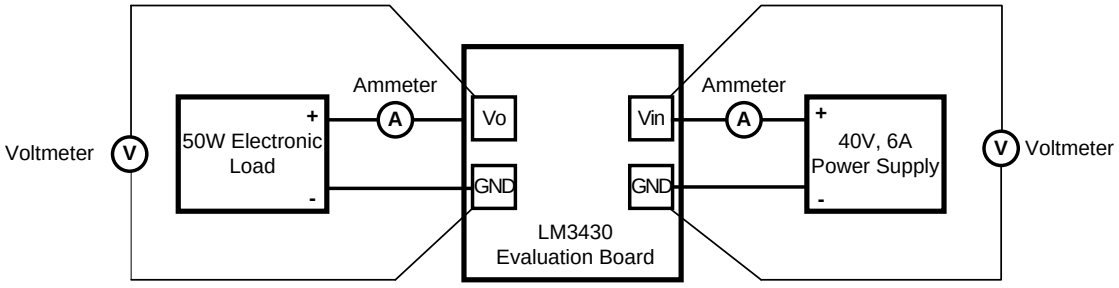


Figure 3. Efficiency Measurement Setup

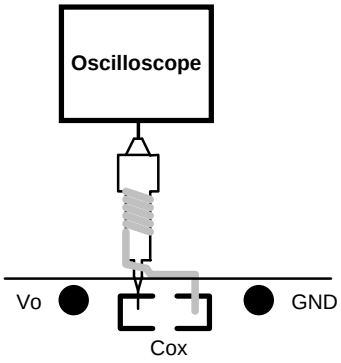


Figure 4. Output Voltage Ripple Measurement Setup

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6 MOSFET Footprints

The LM3430 evaluation board has a footprint for a single MOSFET with an SO-8 package using the industry standard pinout. (See Figure 5). This footprint can also accept newer MOSFET packages that are compatible with SO-8 footprints.

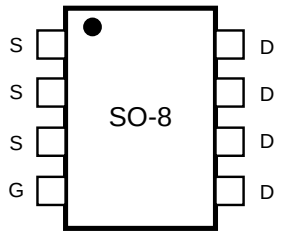


Figure 5. SO-8 MOSFET Pinout

7 Permanent Components

The following components should remain the same for any new circuits evaluated on the LM3430 evaluation board.

Name	Value
Cox, Cinx	0.1 µF
Cf	1 µF
Csns	1 nF
Rpd	10 kΩ
Rs1	100Ω

8 Additional Footprints

The 100 pF capacitor Csyc provides an AC input path for external clock synchronization. Detection of the sync pulse requires a peak voltage level greater than 3.8V at the RT/SYNC pin. Note that the DC voltage at RT/SYNC is approximately 2V to allow compatibility with 3.3V logic. The sync pulse width should be set between 15 ns to 150 ns by the external components. The Rt resistor is always required, whether the oscillator is free running or externally synchronized. Rt must be selected so that the free-running oscillator frequency is below the lowest synchronization frequency.

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9 Typical Performance Characteristics

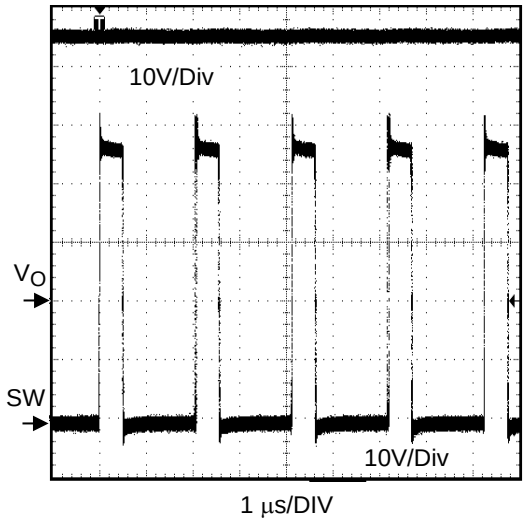


Figure 6. Switch Node Voltage (V_{IN} = 12V, I_o = 0.5A)

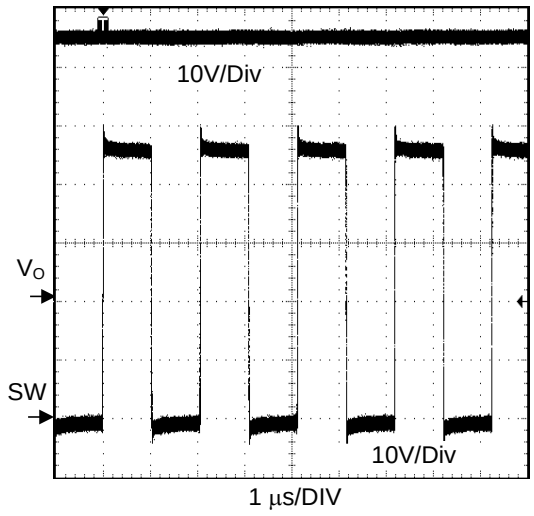


Figure 7. Switch Node Voltage (V_{IN} = 24V, I_o = 0.5A)

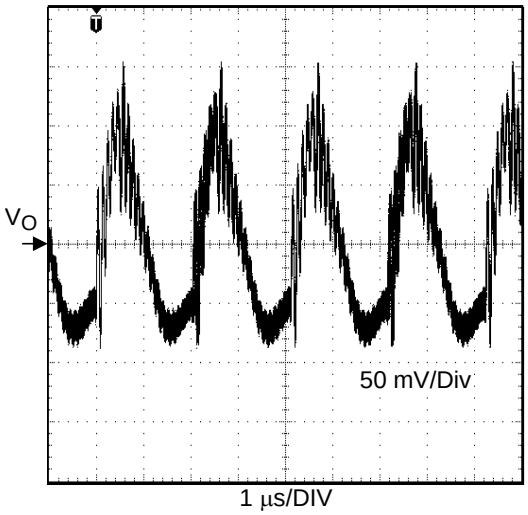


Figure 8. Output Voltage Ripple AC Coupled (V_{IN} = 12V, I_o = 0.5A)

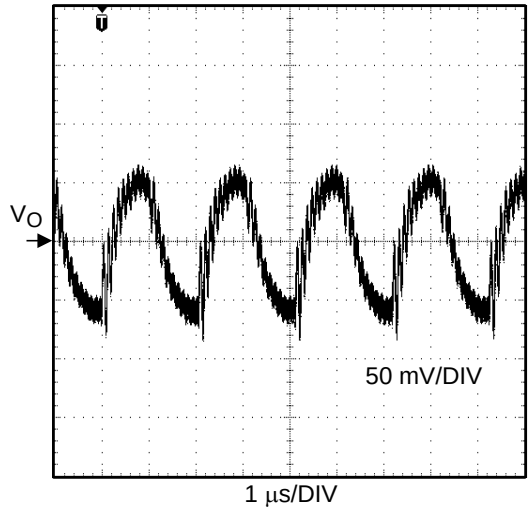


Figure 9. Output Voltage Ripple AC Coupled (V_{IN} = 24V, I_o = 0.5A)

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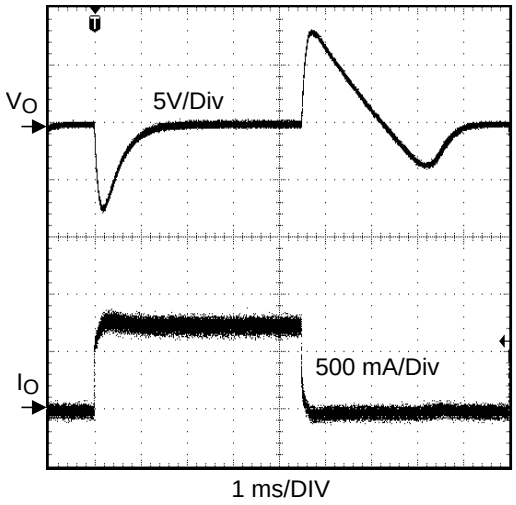


Figure 10. Load Transient Response
(V_{IN} = 12V, I_o = 0 to 0.7A)

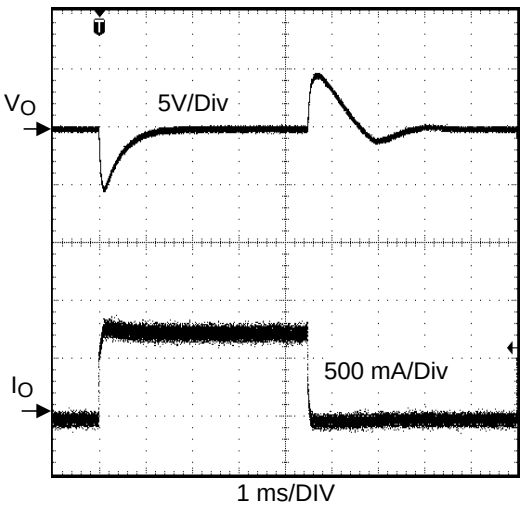


Figure 11. Load Transient Response
(V_{IN} = 24V, I_o = 0 to 0.7A)

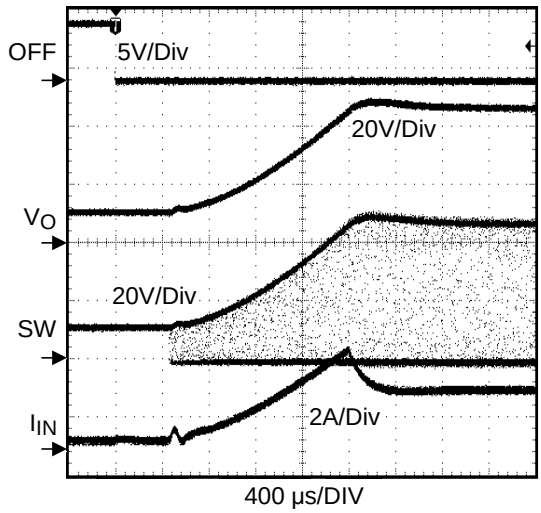


Figure 12. Start Up
(V_{IN} = 12V, I_o = 0.5A)

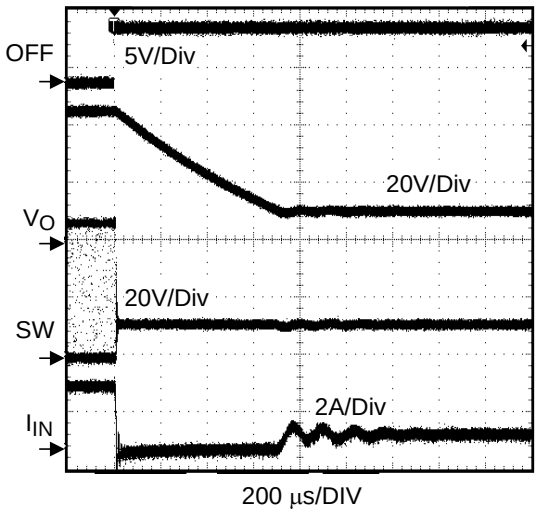


Figure 13. Shutdown
(V_{IN} = 12V, I_o = 0.5A)

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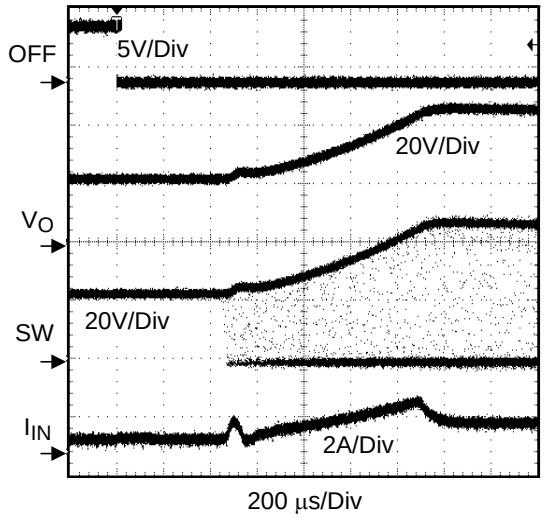


Figure 14. Start Up
(V_{IN} = 24V, I_o = 0.5A)

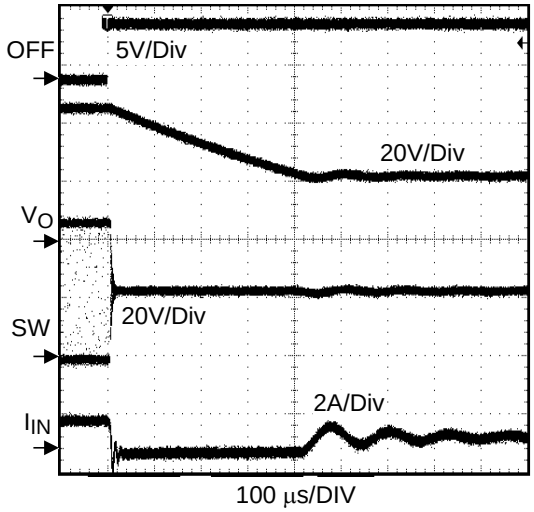


Figure 15. Shutdown
(V_{IN} = 24V, I_o = 0.5A)

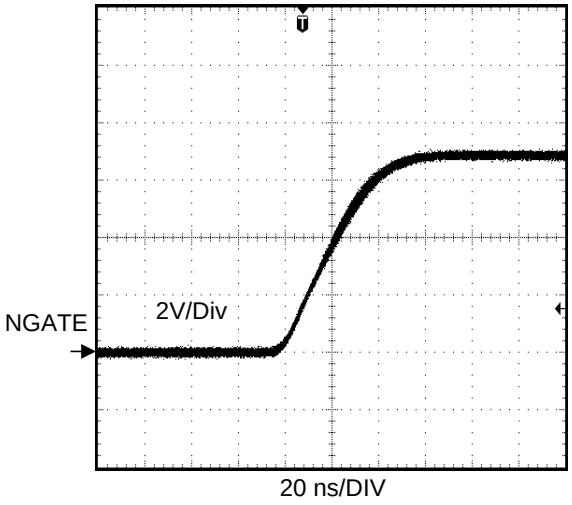


Figure 16. NGATE Rise Time
(V_{IN} = 12V, no-load, Si4850DY)

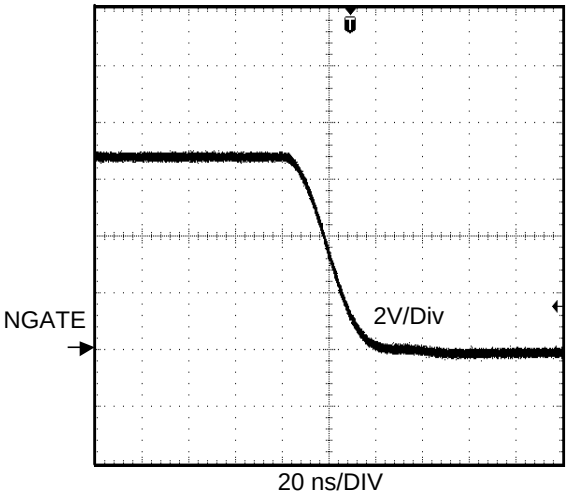


Figure 17. NGATE Fall Time
(V_{IN} = 12V, no-load, Si4850DY)

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10 Bill of Materials

ID	Part Number	Type	Size	Parameters	Qty	Vendor
U1	LM3430	Low-Side Controller	WSON-12		1	Texas Instruments
Q1	Si4850EY	MOSFET	SO-8	60V, 31mΩ, 27nC	1	Vishay
D1	CMSH3-60M	Schottky Diode	SMB	60V, 3A	1	Central Semi
L1	PF0553.333NL	Inductor	12.5x12.5 x8mm	33µH, 6.22A, 60mΩ	1	Pulse
Cin1, Cin2	C4532X7R1H475M	Capacitor	1812	4.7µF, 50V	2	TDK
Co1, Co2	C5750X7R2A475M	Capacitor	2220	4.7µF, 100V, 2mΩ	2	TDK
Cf	C3216X7R1E105K	Capacitor	1206	1µF, 25V	1	TDK
Cinx, Cox	C2012X7R2A104M	Capacitor	0805	100nF 100V	2	TDK
Cc1	VJ0805Y222KXXAT	Capacitor	0805	2.2nF 10%	1	Vishay
Cc2	VJ0805Y224KXXAT	Capacitor	0805	220nF 10%	1	Vishay
Css	VJ0805Y103KXXAT	Capacitor	0805	10nF 10%	1	Vishay
Csns	VJ0805Y102KXXAT	Capacitor	0805	1nF 10%	1	Vishay
Csyc	VJ0805A101KXXAT	Capacitor	0805	100pF 10%	1	Vishay
Rc	CRCW08051621F	Resistor	0805	1.62kΩ 1%	1	Vishay
Rfb1	CRCW08055360F	Resistor	0805	536Ω 1%	1	Vishay
Rfb2	CRCW08052002F	Resistor	0805	20kΩ 1%	1	Vishay
Rs1	CRCW0805331J	Resistor	0805	330Ω 5%	1	Vishay
Rs2	CRCW08054990F	Resistor	0805	499Ω 1%	1	Vishay
Rsns	WSL2010 0.1 1%	Resistor	2010	0.1Ω 1%, 0.5W	1	Vishay
Rt	CRCW08053402F	Resistor	0805	34kΩ 1%	1	Vishay
Ruv1, Ruv2	CRCW0805103J	Resistor	0805	10kΩ 5%	2	Vishay
VIN, Vo, GND, GND2	160-1026	Terminal	0.094”		4	Cambion
GND3, GND4, OFF, SYNC	160-1512	Terminal	0.062”		4	Cambion

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11 PC Board Layout

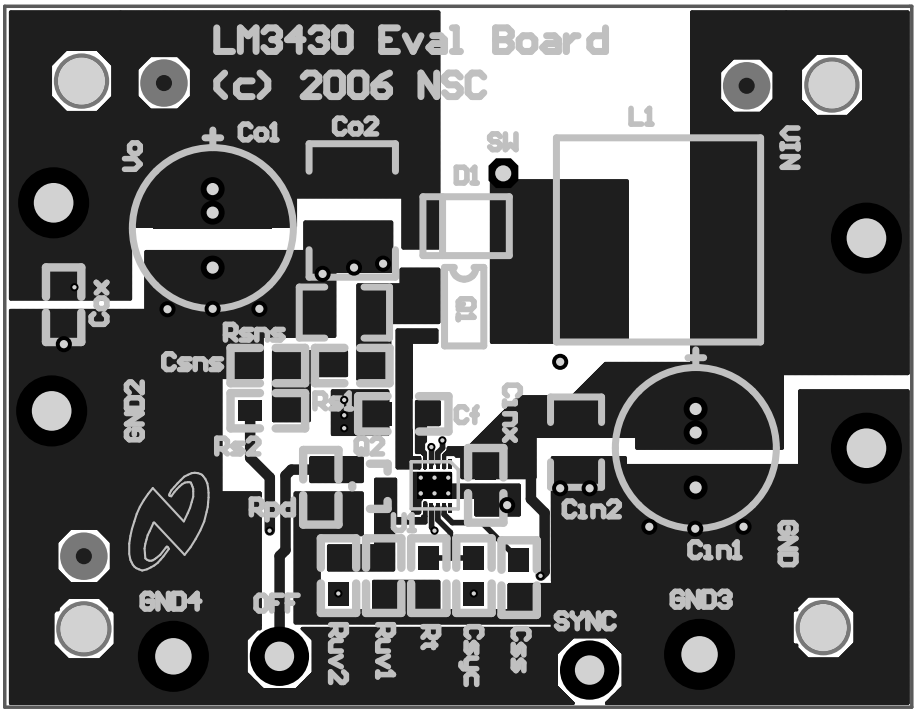


Figure 18. Top Layer and Top Overlay

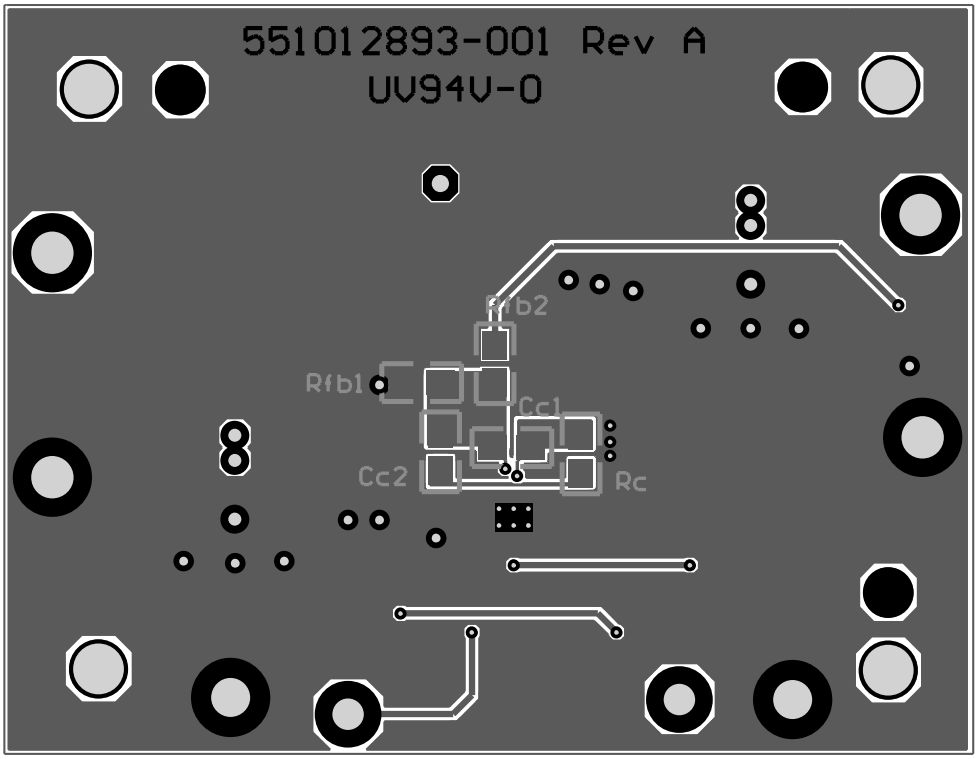


Figure 19. Bottom Layer

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