AN-2170 LMR24210/20 Evaluation Board

1 Introduction

The LMR24210/20 Step Down Switching Regulator features all required functions to implement a cost effective, efficient buck power converter capable of supplying up to 1.0A or 2.0A. The Constant On-Time (COT) regulation scheme requires no loop compensation, results in a fast load transient response and simple circuit implementation, this allows low component count, and consequently very small overall board space. The regulator can function properly even with an all ceramic output capacitor network, and does not rely on the output capacitor's ESR for stability.

The LMR24210/20 has a wide input range from 4.5V-42V, making it suitable for a variety of applications from automotive to power conditioning of unregulated sources. The LMR24210/20 Evaluation Board is designed to provide the design engineer with a fully functional power converter to evaluate the LMR24210/20 series of buck regulators.

2 Features

- 4.5V to 42V Input Voltage Range
- 3.3V Output Voltage (default setting)
- Up to 2000 mA Output Current (LMR24220)
- Up to 1000 mA Output Current (LMR24210)
- Switching Frequency of 500 KHz (default setting)
- PCB size: 46.8mm x 27.4mm

3 Enable Option

Install R4, R5 and D1 to enable the part at a desider input voltage. A voltage higher than 1.26V on the EN pin will enable the device. Use the EN post to disable the device by pulling this node to GND. A logic signal may be applied, to the post, to test startup and shutdown of the device. Leaving the EN pin open will enable the device at internal UVLO level.

4 Adjusting the Output Voltage

The output voltage can be changed from 3.3V to another voltage by adjusting the feedback resistors using Equation 1:

$$V_{OUT} = V_{FB}(1+(R1/R2)) \quad (1)$$

Where V_{FB} is 0.8V.

For more information on component selection and features, see the *LMR24210 SIMPLE SWITCHER® 42Vin, 1.0A Step-Down Voltage Regulator* (SNVS738) and *LMR24220 SIMPLE SWITCHER 42Vin, 2.0A Stp-Dwn V-Reg in micro SMD* (SNVS737) data sheets.

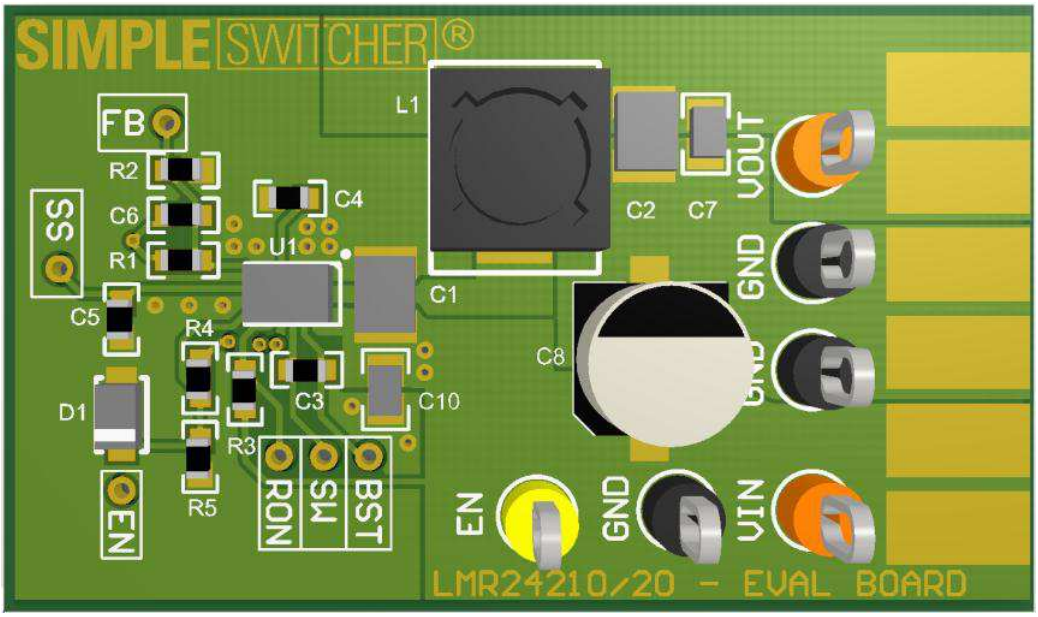
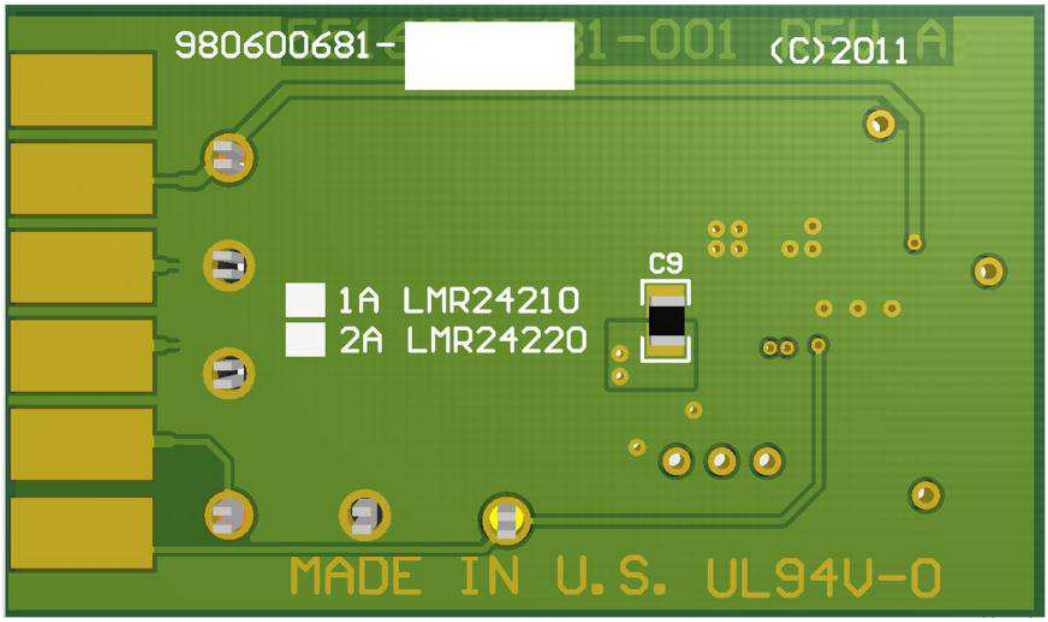


Figure 1. Top View



Bottom View

Figure 2. LMR24210/20 Evaluation Board

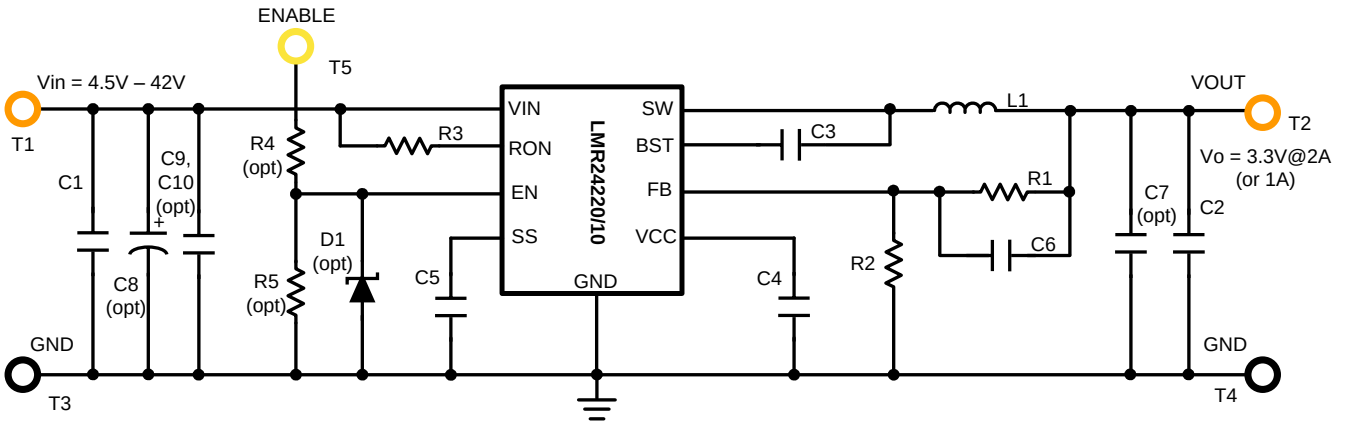


Figure 3. LMR24210/20 Evaluation Board Schematic

Table 1. Bill of Materials (BOM) LMR24210/20

Designation	Description	Size	Manufacturer Part #	Vendor
C1	Cap 10µF 50V X5R	1210	UMK325BJ106MMT	Taiyo Yuden
C2	Cap 47µF 10V X5R	1210	GRM32ER61A476KE20L	Murata
C3,C5,C6	Cap 0.01µF 100V X7R	0603	06031C103MAT2A	AVX
C4	Cap 1µF 10V X5R	0603	C0603C105K8PACTU	Kemet
R1	RES, 31.6k ohm, 1%, 0.1W	0603	CRCW060331K6FKEA	Vishay
R2	RES, 10.2k ohm, 1%, 0.1W	0603	CRCW060310K2FKEA	Vishay
R3	RES, 49.9k ohm, 1%, 0.1W	0603	CRCW060349K9FKEA	Vishay
L1	Shielded Inductor 8.2µH 2.53A		DR74-8R2-R	Colitronics
U1	IC LMR24210/20	28-ball DSBGA	LMR24210/20	TI
R4,R5	optional			
C7,C8,C9,C10	optional			
D1	optional			
T1,T2	test point (orange)	Keystone5013		
T3,T4	test point (black)	Keystone5011		
T5	test point (yellow)	Keystone5014		

5 Optional components

R4,**R5** set the input voltage level at which the device is enabled.

D1 is a zener diode that clamps the voltage on the EN pin. A 5.1V zener is suggested.

C7 is an additional output capacitor.

C8 is an input bulk capacitor. The bulk capacitor should be located near the Power-supply connection point. The purpose of the bulk capacitor is to overcome the inductive effects of bench wiring.

C9,**C10** are additional input capacitors.

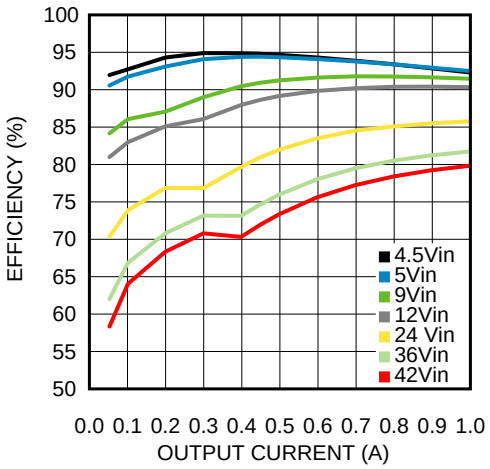
6 Test Setup

Table 2. Demonstration Board Quick Setup Procedures

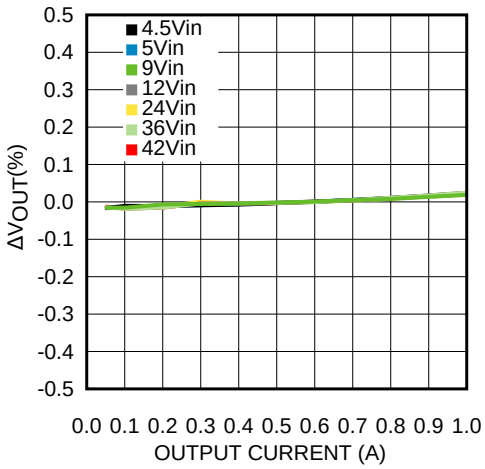
Step	Description	Notes
1	Connect a power supply to V_{IN} terminals	V_{IN} range: 4.5V to 42V
2	Connect a load to V_{OUT} terminals	I_{OUT} range: 0A to 2.0A (or 1A)
3	EN should be left floating for normal operation. Short this to ground to shutdown the part	
4	Turn on V_{IN} with 0A load applied, check V_{OUT} with a voltmeter	Nominal 3.3V
5	Apply a 2.0A (or 1A) load and check V_{OUT}	Nominal 3.3V

7 Typical Performance Characteristics for LMR24210

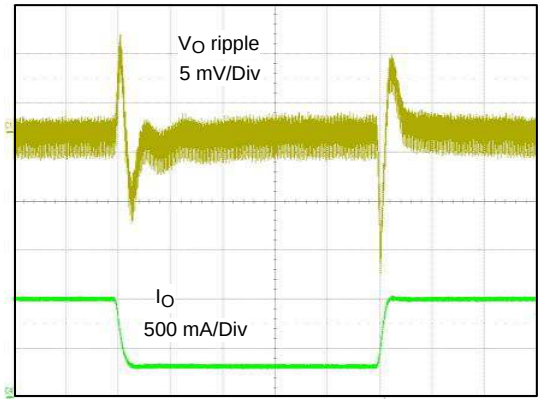
Efficiency vs. Load Current



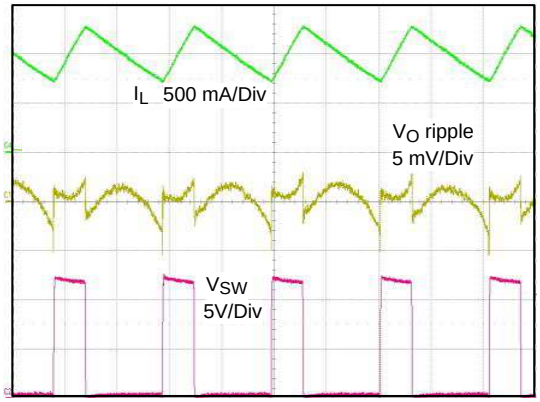
Load Regulation



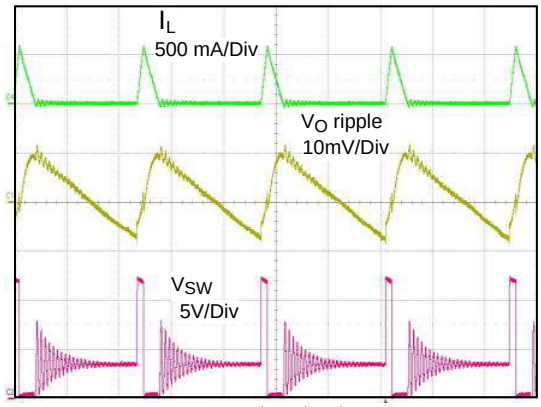
Load Transient Waveforms 300mA to 1A, $12V_{IN}$



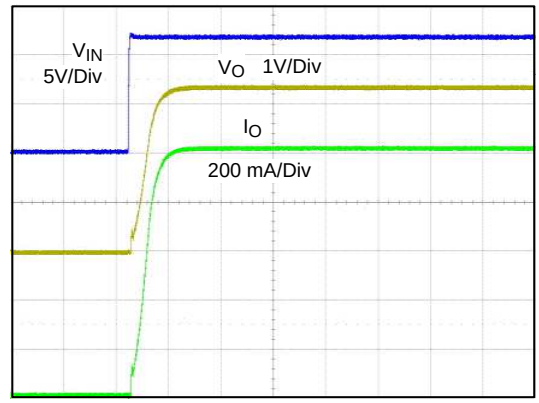
Switching Waveforms CCM, 1A, $12V_{IN}$



Switching Waveforms DCM, 50mA, $12V_{IN}$

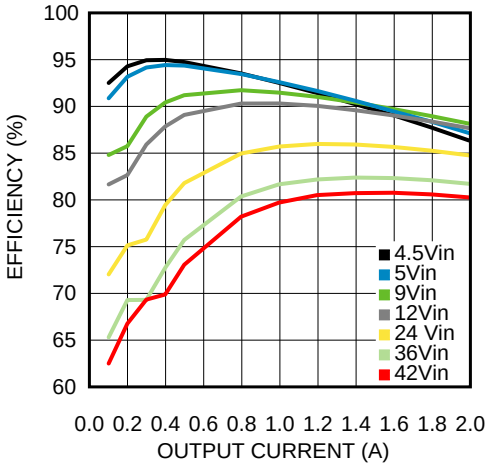


Startup Waveforms

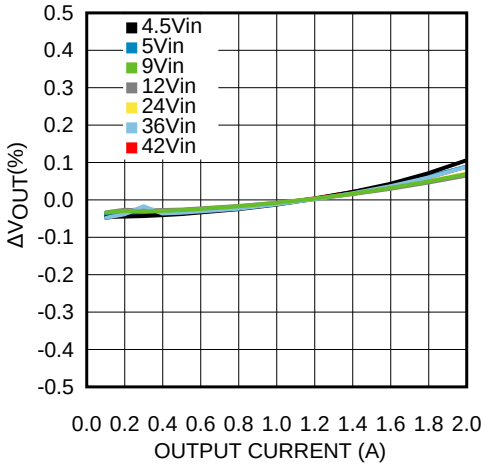


8 Typical Performance Characteristics for LMR24220

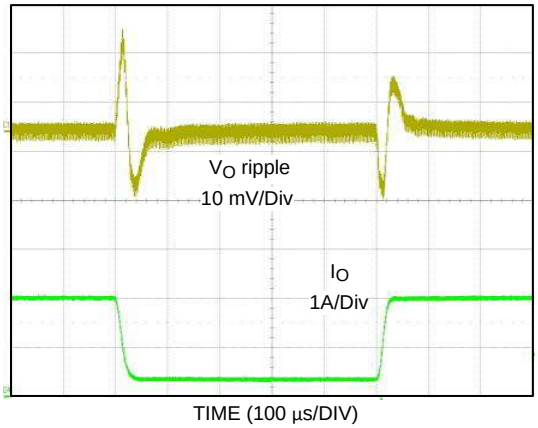
Efficiency vs. Load Current



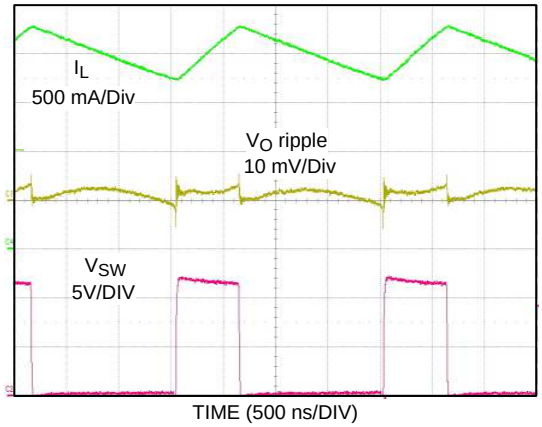
Load Regulation



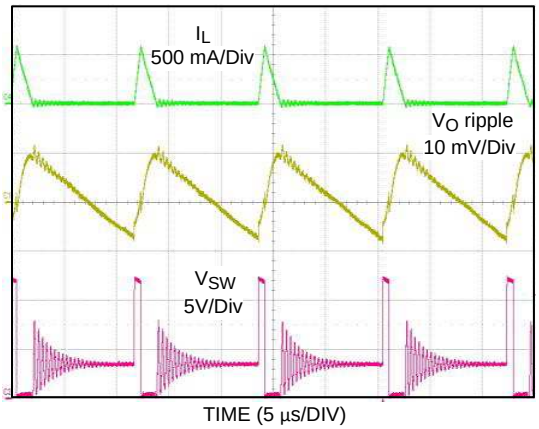
Load Transient Waveforms 300mA to 2A, $12V_{IN}$



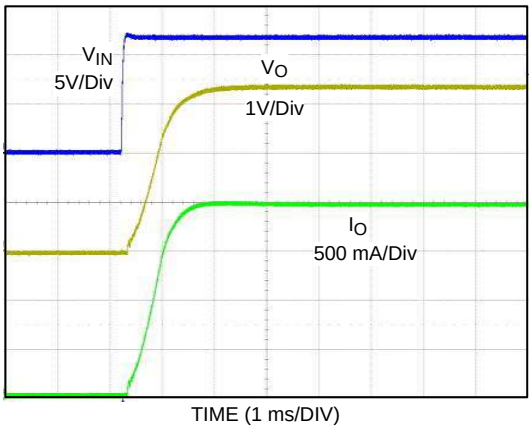
Switching Waveforms CCM, 2A, $12V_{IN}$



Switching Waveforms DCM, 50mA, $12V_{IN}$



Startup Waveforms



9 Layout

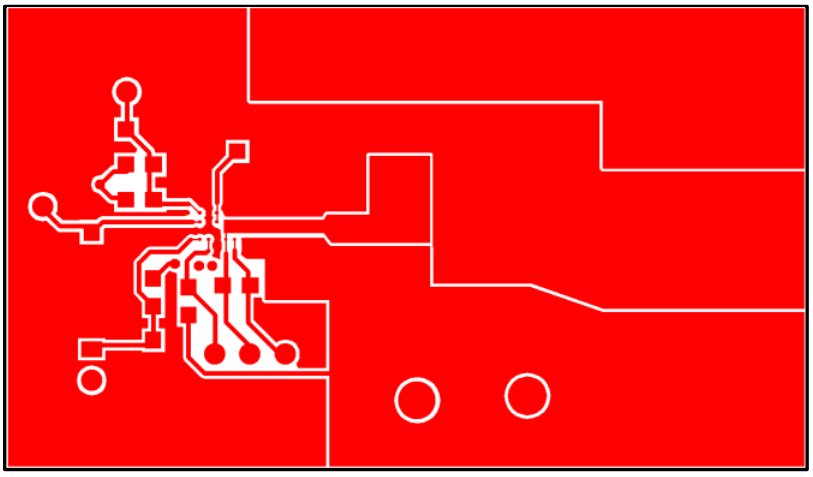


Figure 4. Top Layer

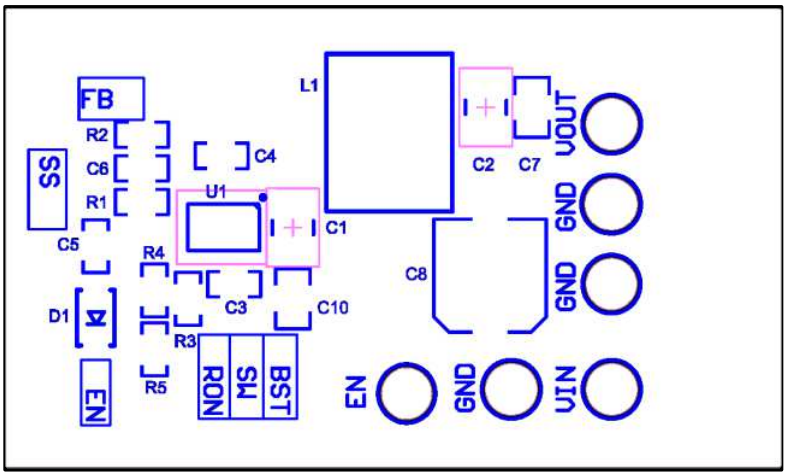


Figure 5. Top Silkscreen

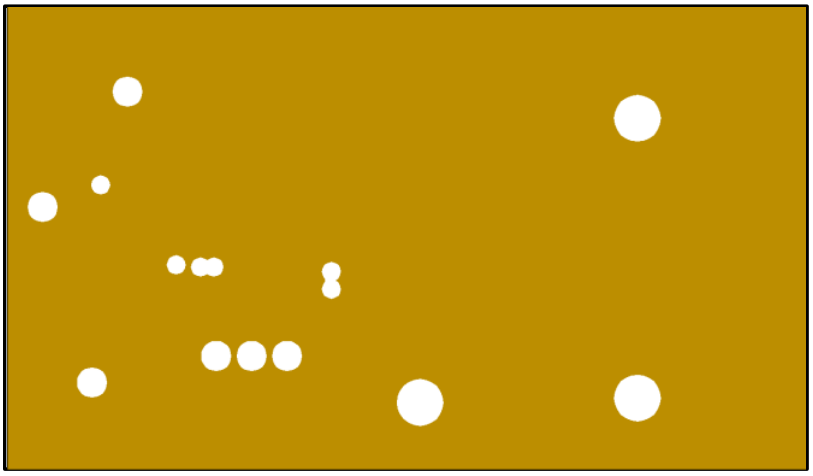


Figure 6. Mid Layer 1

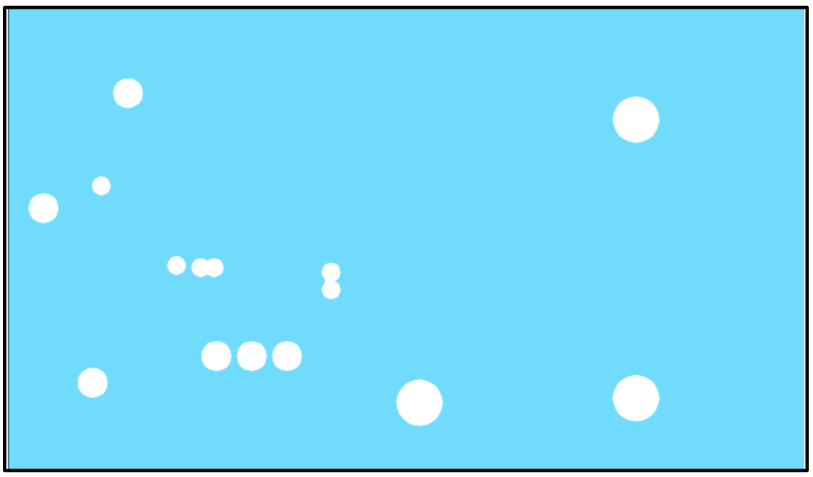


Figure 7. Mid Layer 2

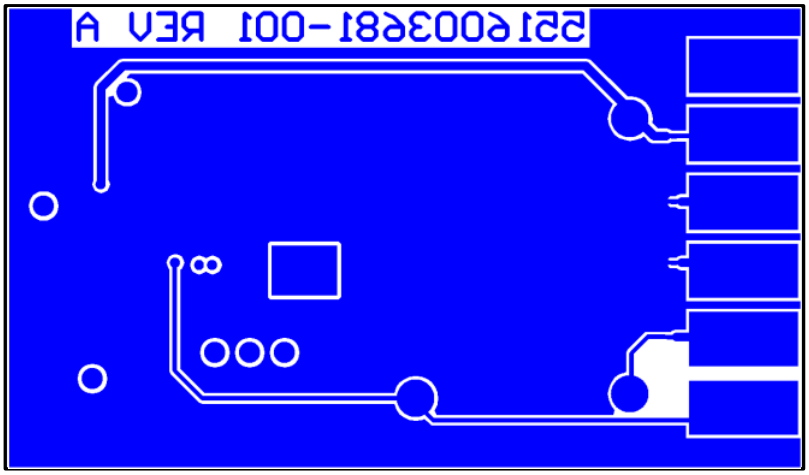


Figure 8. Bottom Layer

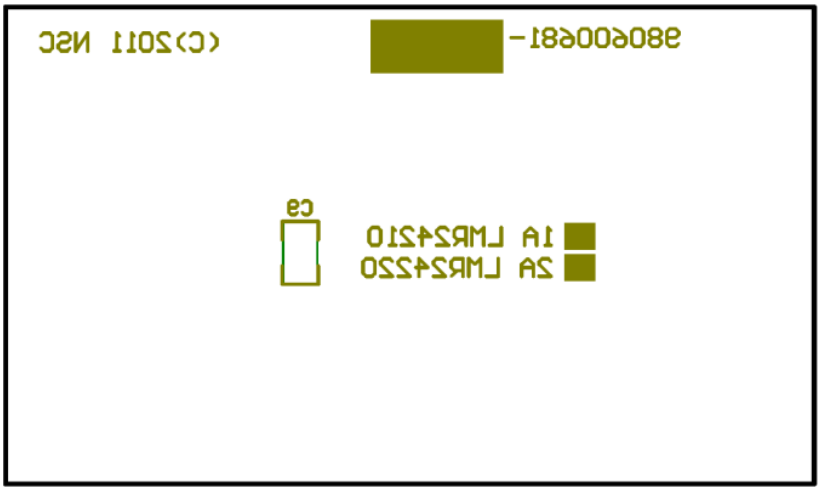


Figure 9. Bottom Silkscreen

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