

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 desired 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.

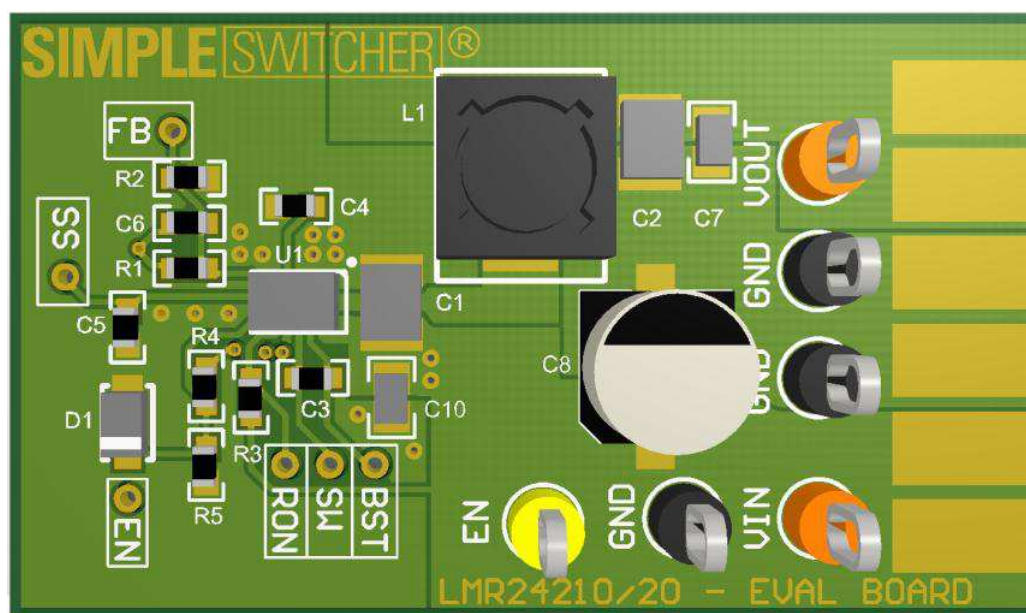
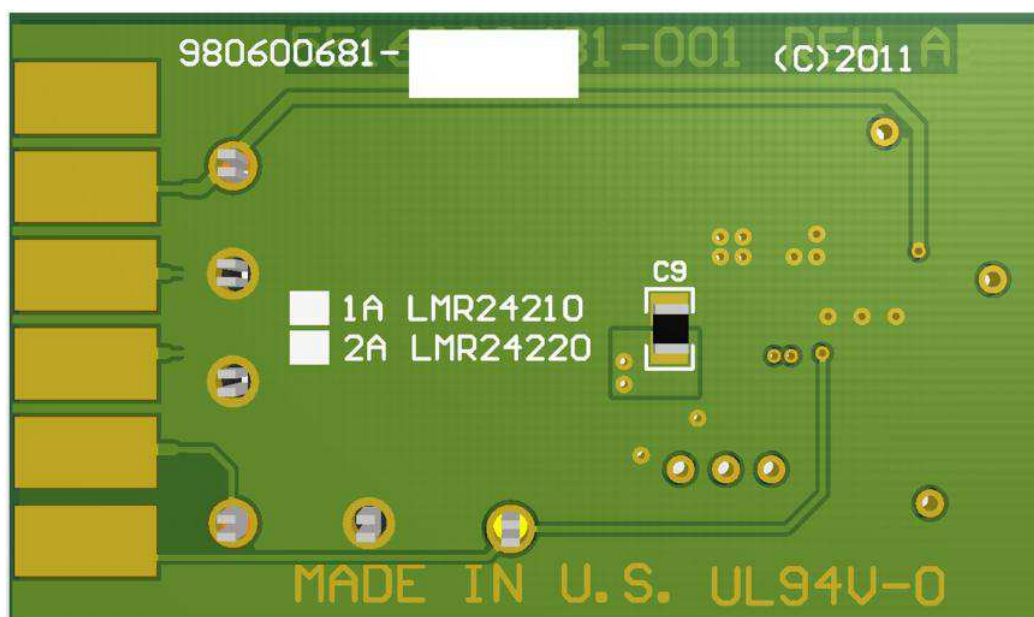
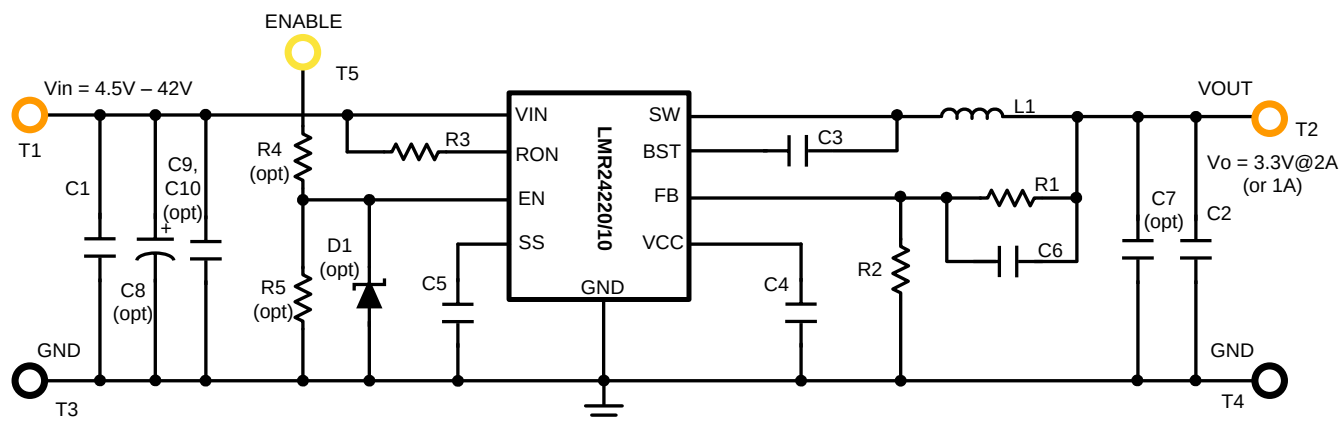


Figure 1. Top View



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 10 μ F 50V X5R	1210	UMK325BJ106MMT	Taiyo Yuden
C2	Cap 47 μ F 10V X5R	1210	GRM32ER61A476KE20L	Murata
C3,C5,C6	Cap 0.01 μ F 100V X7R	0603	06031C103MAT2A	AVX
C4	Cap 1 μ F 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 8.2 μ H 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.

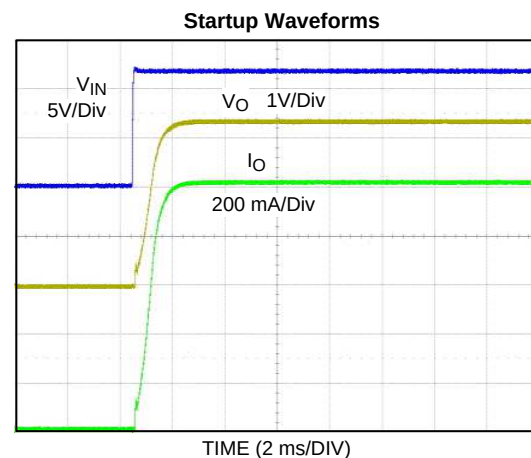
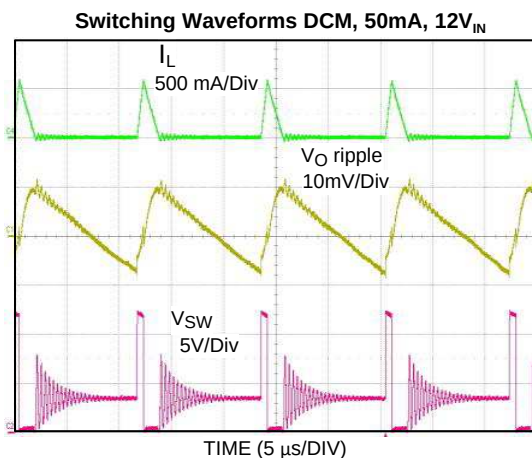
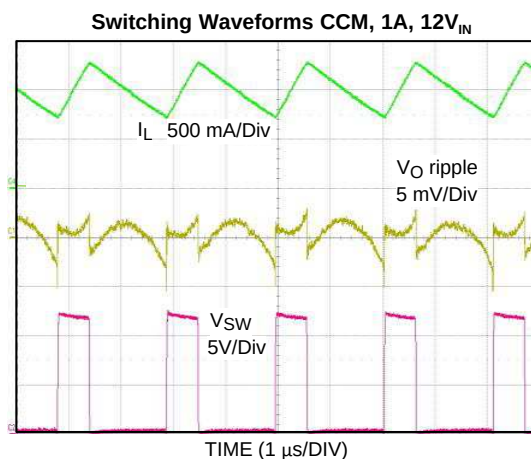
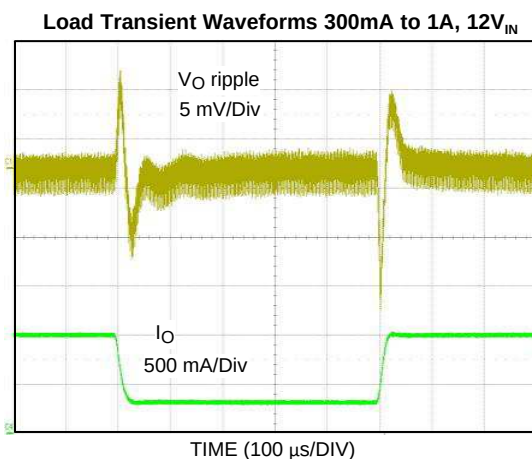
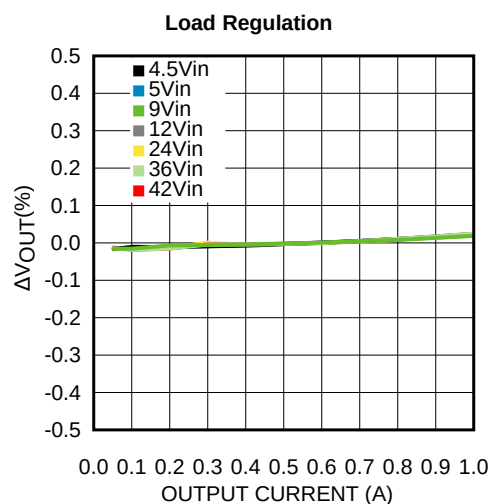
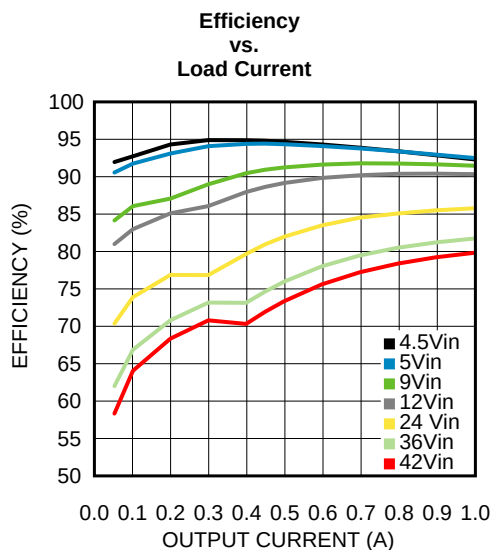
C9,C10 are additional input capacitors.

6 Test Setup

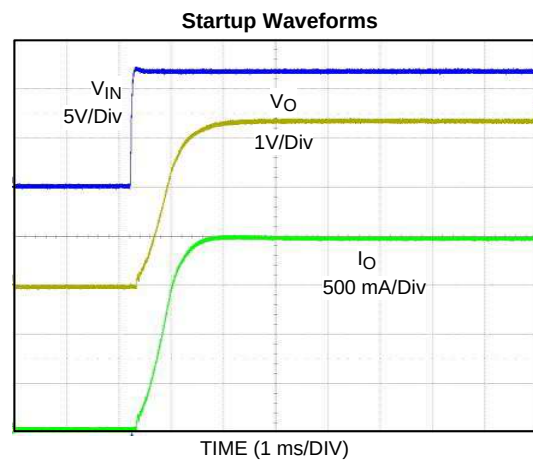
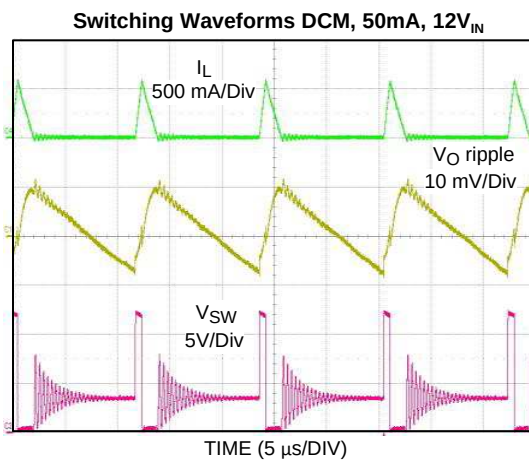
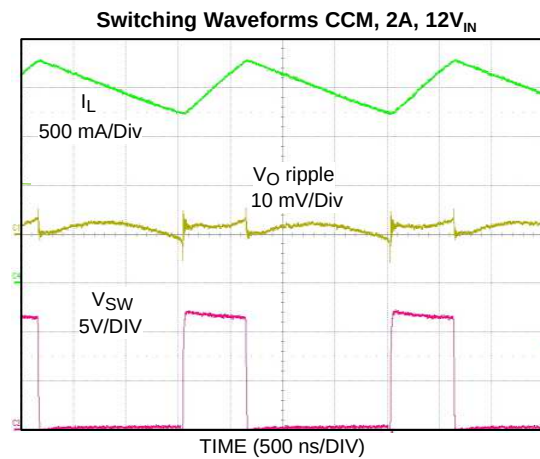
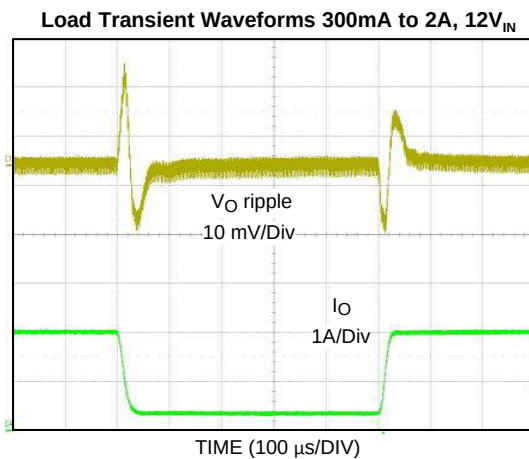
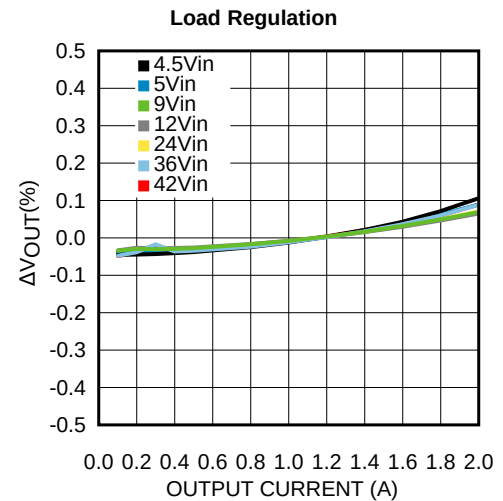
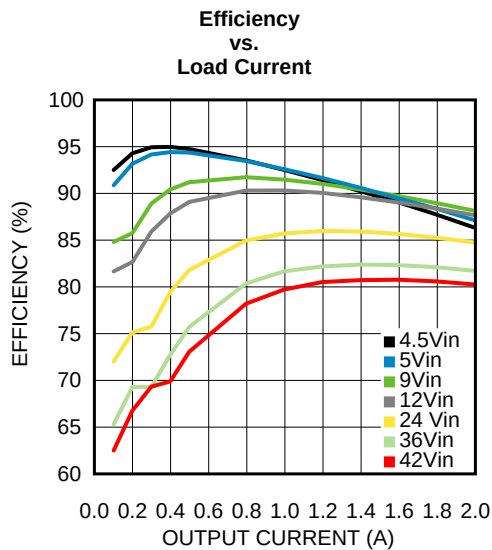
Table 2. Demonstration Board Quick Setup Procedures

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



8 Typical Performance Characteristics for LMR24220



9 Layout

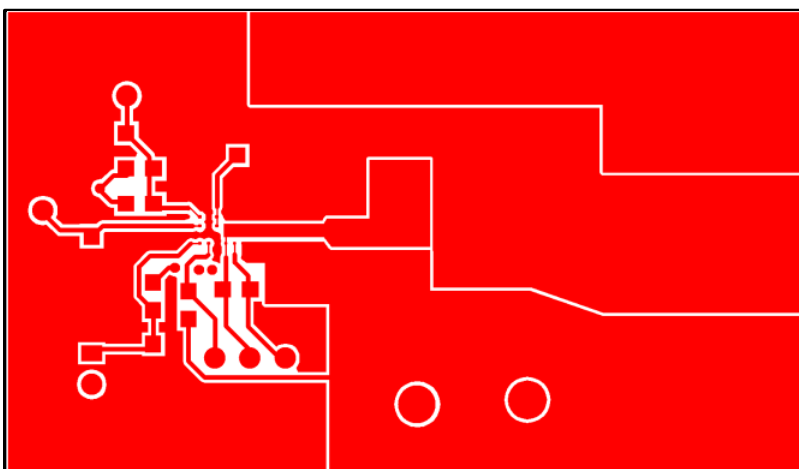


Figure 4. Top Layer

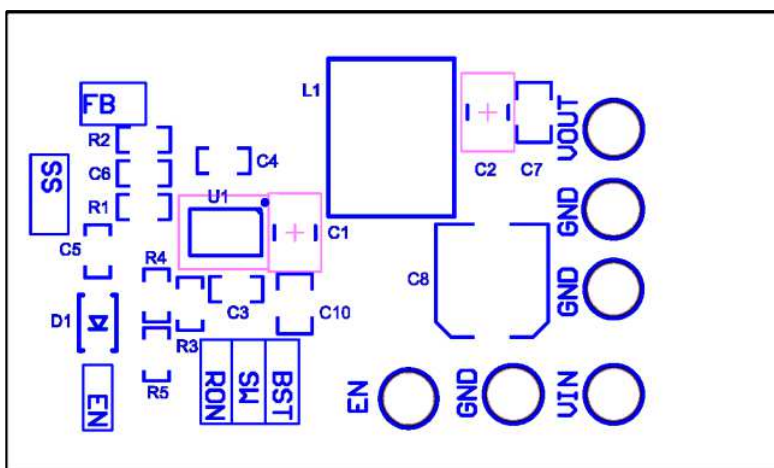


Figure 5. Top Silkscreen

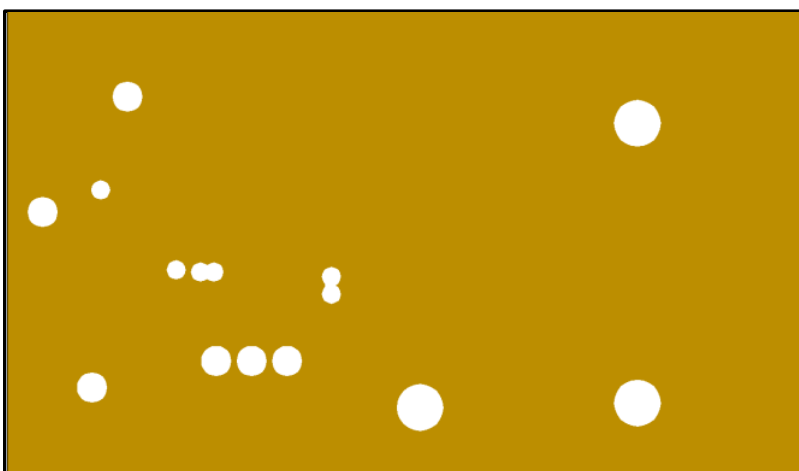


Figure 6. Mid Layer 1



Figure 7. Mid Layer 2

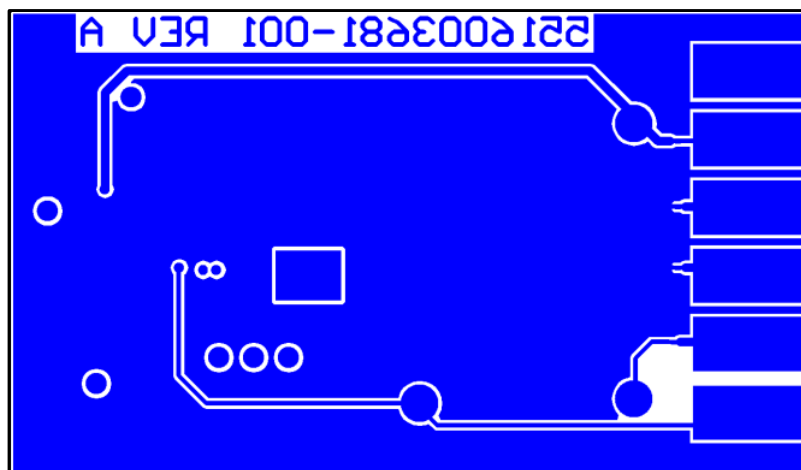


Figure 8. Bottom Layer



Figure 9. Bottom Silkscreen

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NOTE:

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3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

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This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

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