

AN-2184 LMR10510/LMR10515/LMR10520 Demo Board

1 Introduction

The Texas Instruments LMR10510/LMR10515/LMR10520 is a PWM DC/DC buck (step-down) regulator. With a switching frequency of 3MHz or 1.6MHz the overall solution size is very compact and requires a minimum number of components. The LMR10510/LMR10515/LMR10520 Demo Board is designed to provide the design engineer with a fully functional power converter to evaluate the LMR10510/LMR10515/LMR10520 series of buck regulators. The demo board comes populated with either the LMR10510Y, LMR10515Y, or LMR10520Y but can easily be modified to accommodate any of the LMR10510/LMR10515/LMR10520 regulator ICs.

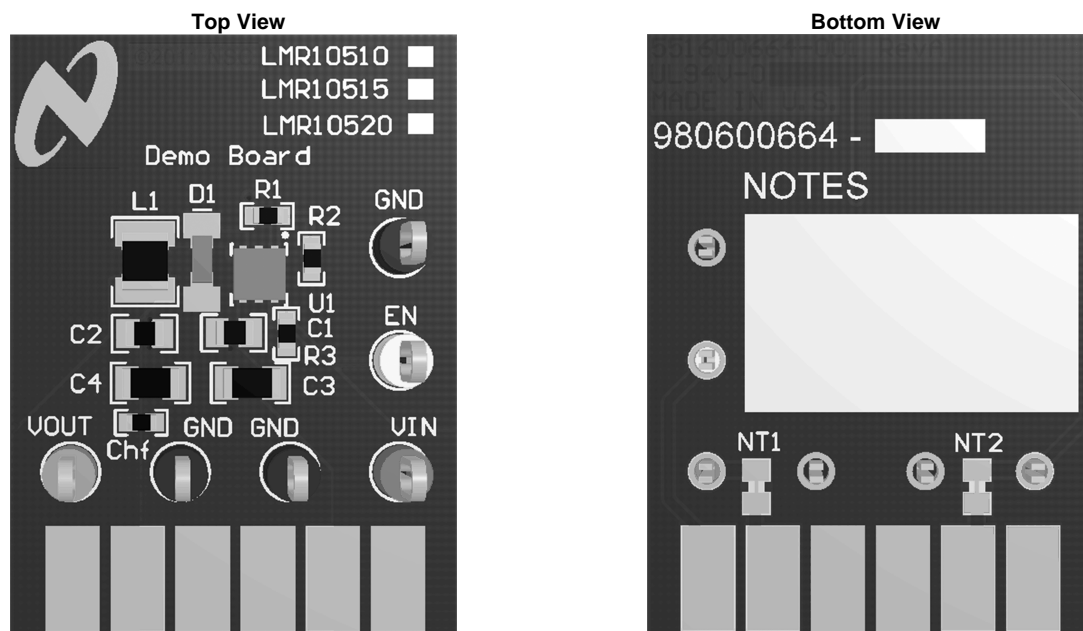


Figure 1. LMR10510/LMR10515/LMR10520 Demo Board

2 Features

- 3.0V to 5.5V Input Voltage Range
- 1.8V Output Voltage (Default Setting)
- 1A/1.5A/2.0A Output Current
- Switching Frequency of 3MHz
- Small Solution Size (13 × 12mm)

3 Shutdown Operation

The demo board includes a pull-up resistor, R3, to enable the device once V_{IN} has exceeded 1.8V (typ). 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.

4 Adjusting the Output Voltage

The output voltage can be changed from 1.8V to another voltage by adjusting the feedback resistors using the following equation:

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

Where V_{FB} is 0.6V.

For more information on component selection and features, see:

- *LMR10510 SIMPLE SWITCHER 5.5Vin, 1A Step-Down Voltage Regulator in SOT-23 and WSON* ([SNVS727](#))
- *LMR10515 SIMPLE SWITCHER 5.5Vin, 1.5A Step-Down Voltage Regulator in SOT-23 and WSON* ([SNVS728](#))
- *LMR10520 SIMPLE SWITCHER 5.5Vin, 2.0A Step-Down Voltage Regulator in WSON* ([SNVS730](#))

5 LMR10510 Demo Board Schematic

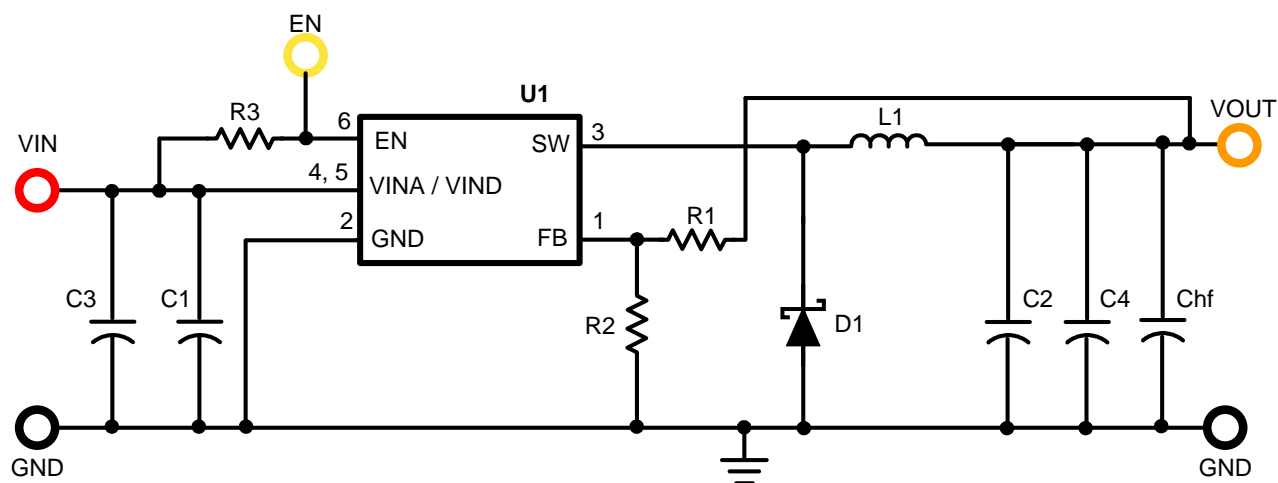


Figure 2. LMR10510 Demo Board Schematic

Table 1. Bill of Materials LMR10510Y

Part ID	Part Value	Manufacturer	Part Number	Package Type
U1	1A Buck Regulator	Texas Instruments	LMR10510	WSO8
C1, C2	2.2µF, 10V, X5R	TDK	C2012X5R1A225K	0805
C3, C4	22µF, 6.3V, X5R	TDK	C3216X5R0J226M	1206
Chf	22nF, 50V, X7R	Murata	GRM188R71H223KA01D	0603
D1, Catch Diode	Schottky 1.5A, 30VR	Toshiba	CRS08	SFLAT
L1	1.0 µH, 2.05A, 45mΩ	Murata	LQH32PN1R0NN0	
R1	20.0 KΩ, 1%	Vishay	CRCW060320K0FKEA	0603
R2	10.0 KΩ, 1%	Vishay	CRCW060310K0FKEA	0603
R3	1 MegΩ, 5%	Vishay	CRCW06031M00JNEA	0603
GND	Test Point, Black	Keystone	5011	
VIN	Test Point, Red	Keystone	5010	
VOUT	Test Point, Orange	Keystone	5013	
EN	Test Point, Yellow	Keystone	5014	

6 LMR10515 Demo Board Schematic

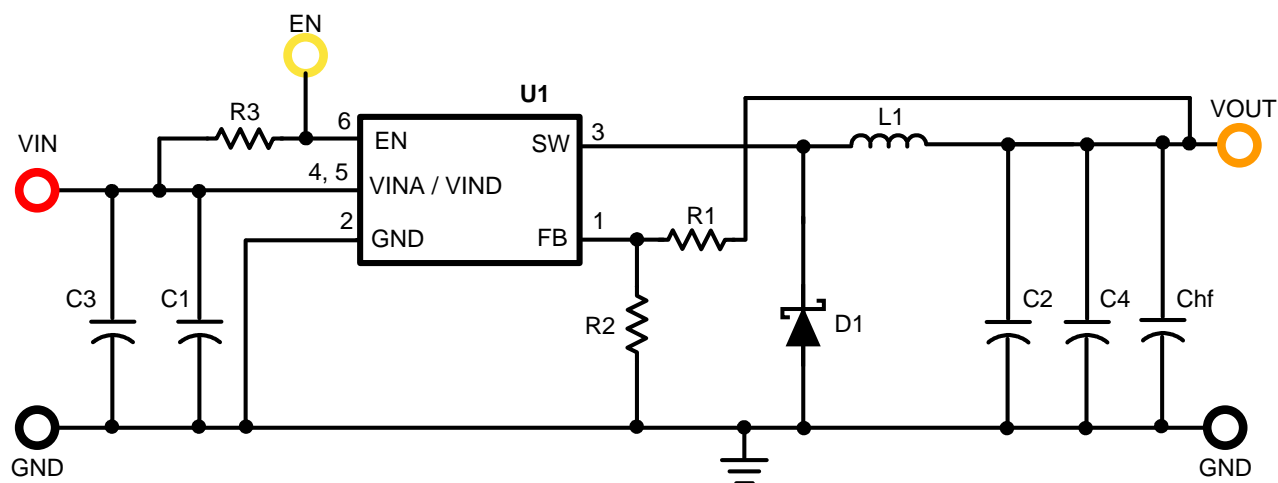


Figure 3. LMR10515 Demo Board Schematic

Table 2. Bill of Materials LMR10515Y

Part ID	Part Value	Manufacturer	Part Number	Package Type
U1	1.5A Buck Regulator	Texas Instruments	LMR10515	WSO8
C1, C2	2.2μF, 10V, X5R	TDK	C2012X5R1A225K	0805
C3, C4	22μF, 6.3V, X5R	TDK	C3216X5R0J226M	1206
Chf	22nF, 50V, X7R	Murata	GRM188R71H223KA01D	0603
D1, Catch Diode	Schottky 1.5A, 30VR	Toshiba	CRS08	SFLAT
L1	1.0 μH, 2.05A, 45mΩ	Murata	LQH32PN1R0NN0	
R1	20.0 KΩ, 1%	Vishay	CRCW060320K0FKEA	0603
R2	10.0 KΩ, 1%	Vishay	CRCW060310K0FKEA	0603
R3	1 MegΩ, 5%	Vishay	CRCW06031M00JNEA	0603
GND	Test Point, Black	Keystone	5011	
VIN	Test Point, Red	Keystone	5010	
VOUT	Test Point, Orange	Keystone	5013	
EN	Test Point, Yellow	Keystone	5014	

7 LMR10520 Demo Board Schematic

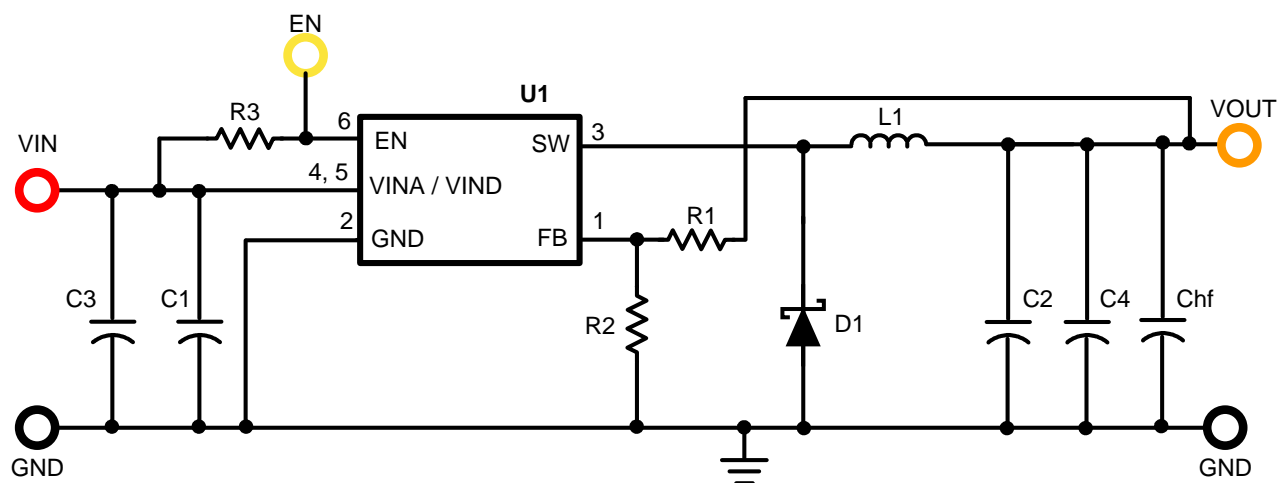


Figure 4. LMR10520 Demo Board Schematic

Table 3. Bill of Materials LMR10520Y

Part ID	Part Value	Manufacturer	Part Number	Package Type
U1	2A Buck Regulator	Texas Instruments	LMR10520	WSO8
C1, C2	2.2μF, 10V, X5R	TDK	C2012X5R1A225K	0805
C3, C4	22μF, 6.3V, X5R	TDK	C3216X5R0J226M	1206
Chf	22nF, 50V, X7R	Murata	GRM188R71H223KA01D	0603
D1, Catch Diode	Schottky 2A, 30V	Toshiba	CMS06	MFLAT
L1	1.0 μH, 2.45A, 30mΩ	Murata	LQH44PN1R0NP0L	
R1	20.0 KΩ, 1%	Vishay	CRCW060320K0FKEA	0603
R2	10.0 KΩ, 1%	Vishay	CRCW060310K0FKEA	0603
R3	1 MegΩ, 5%	Vishay	CRCW06031M00JNEA	0603
GND	Test Point, Black	Keystone	5011	
VIN	Test Point, Red	Keystone	5010	
VOUT	Test Point, Orange	Keystone	5013	
EN	Test Point, Yellow	Keystone	5014	

8 Quick Setup Procedures

Step 1: Connect a power supply to VIN terminals. V_{IN} range: 3V to 5.5V

Step 2: Connect a load to VOUT terminals. I_{OUT} range: 0A to 1A / 1.5A / 2.0A

Step 3: EN should be left floating for normal operation. Short this to ground to shutdown the part.

Step 4: Apply $V_{IN} = 5V$, with 0A load applied, check V_{OUT} with a voltmeter. Nominal 1.8V

Step 5: Apply a 1A / 1.5A / 2.0A load and check V_{OUT} . Nominal 1.8V

9 Measurements

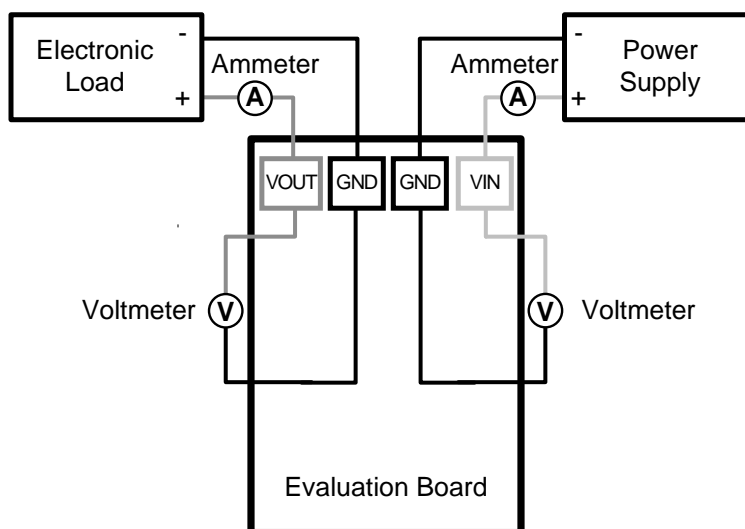


Figure 5. Efficiency Measurements

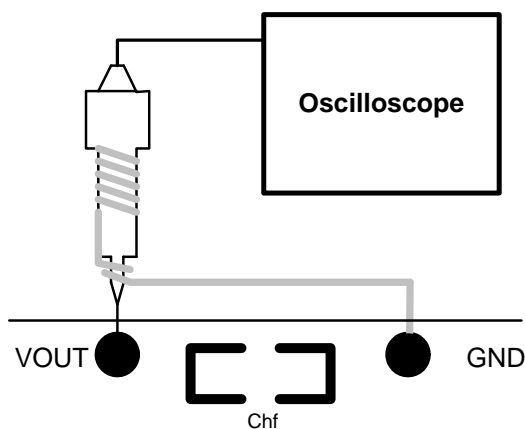


Figure 6. Voltage Ripple Measurements

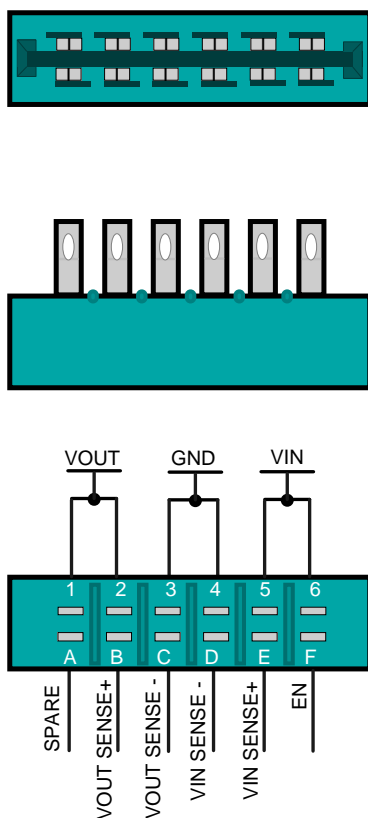
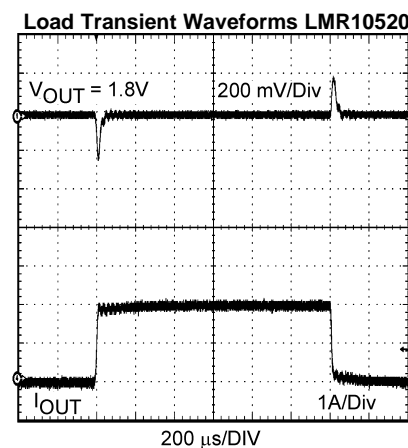
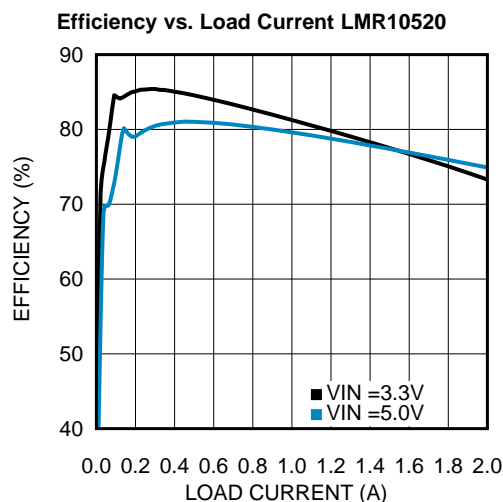
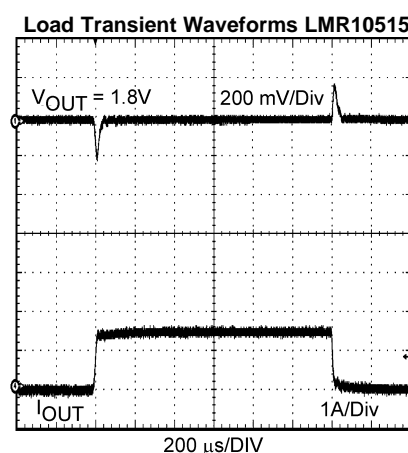
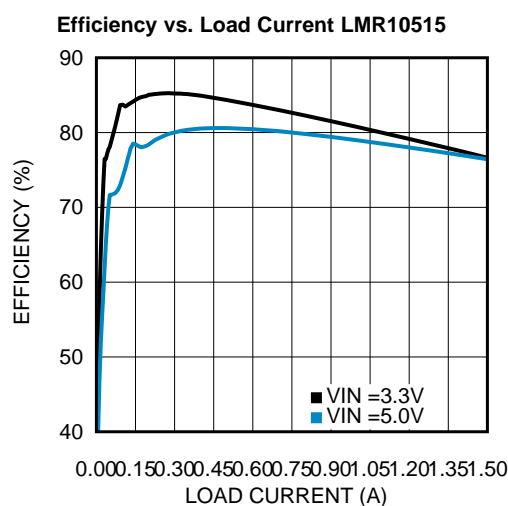
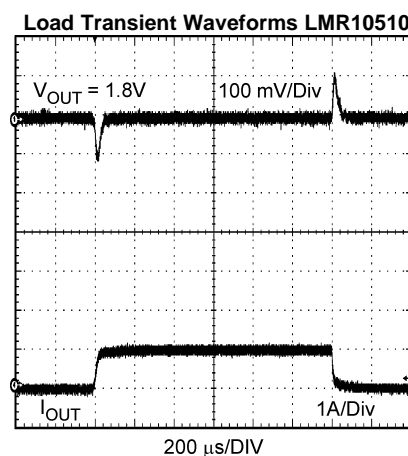
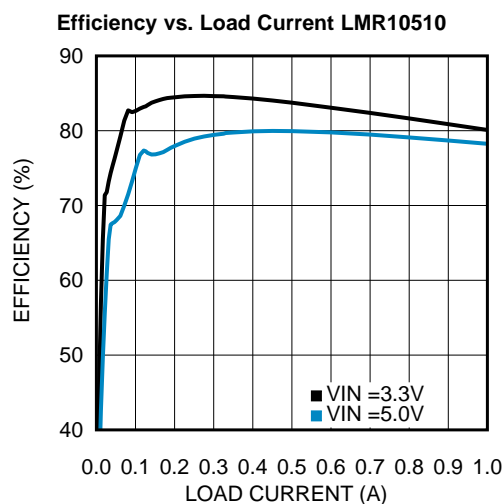
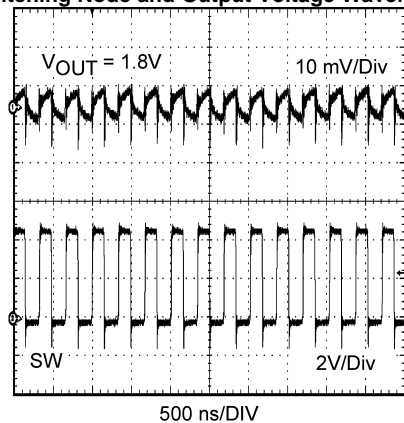


Figure 7. Edge Connector Schematic

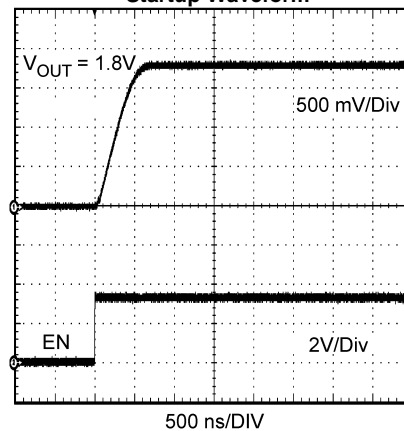
10 Typical Performance Characteristics



Switching Node and Output Voltage Waveforms



Startup Waveform



11 Layout

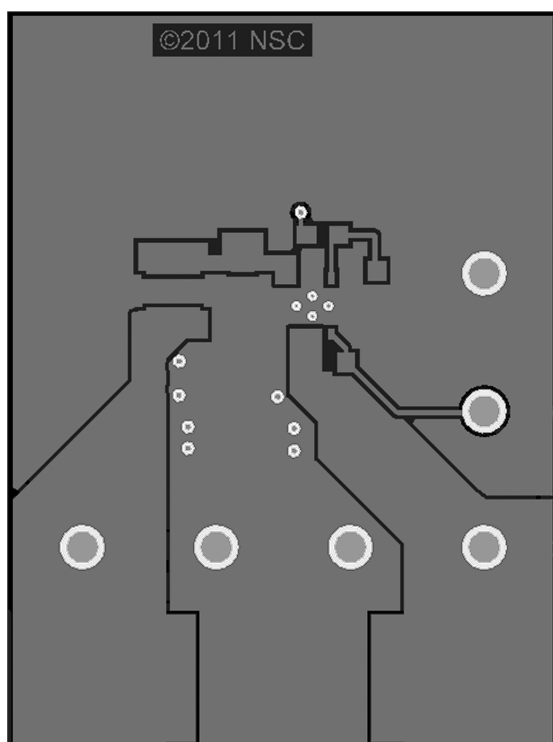


Figure 8. Top Layer

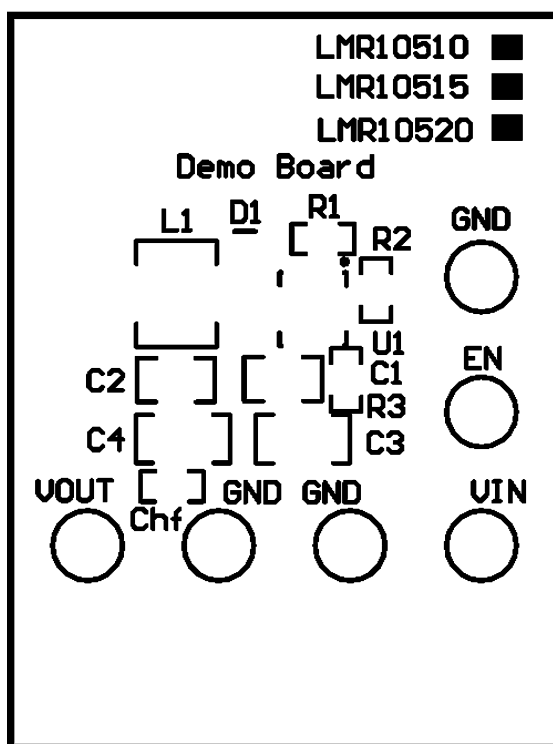


Figure 9. Top Overlay

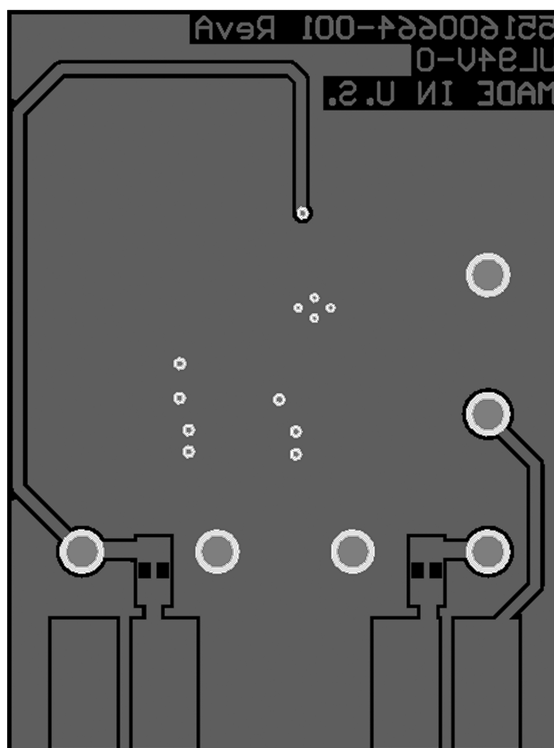


Figure 10. Bottom Layer

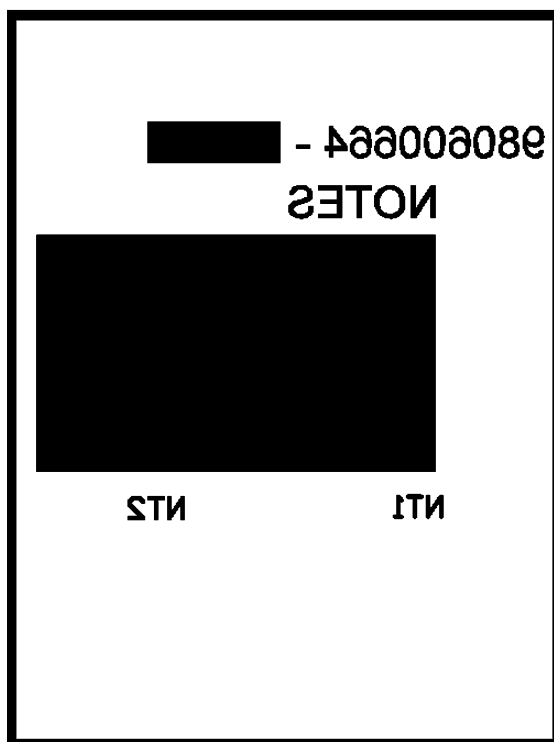


Figure 11. Bottom Overlay

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com