# 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.

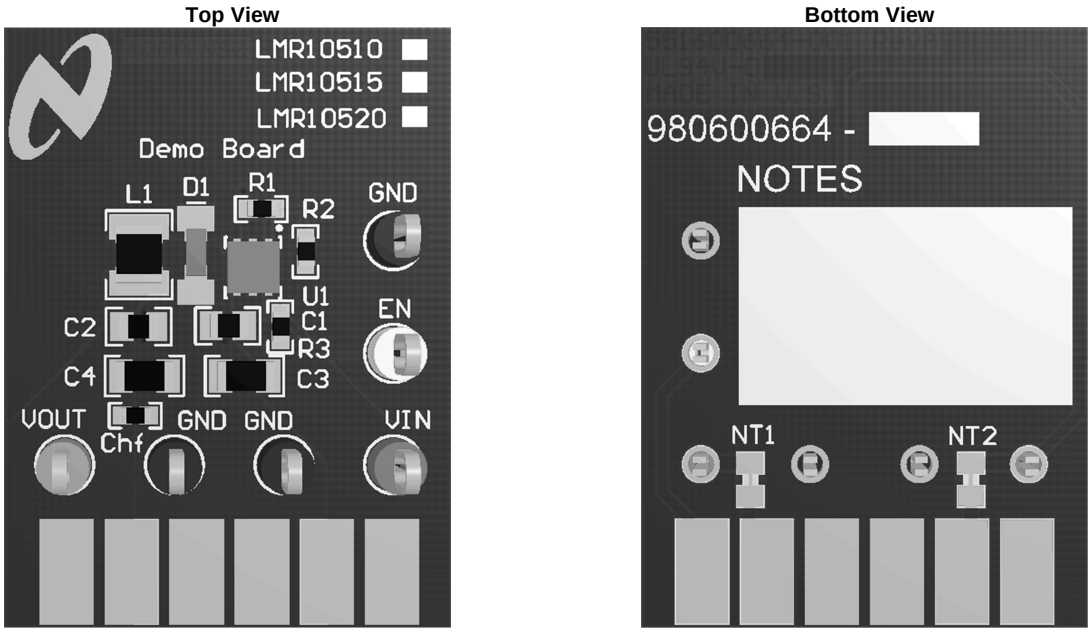



**Figure 1. LMR10510/LMR10515/LMR10520 Demo Board**

## 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

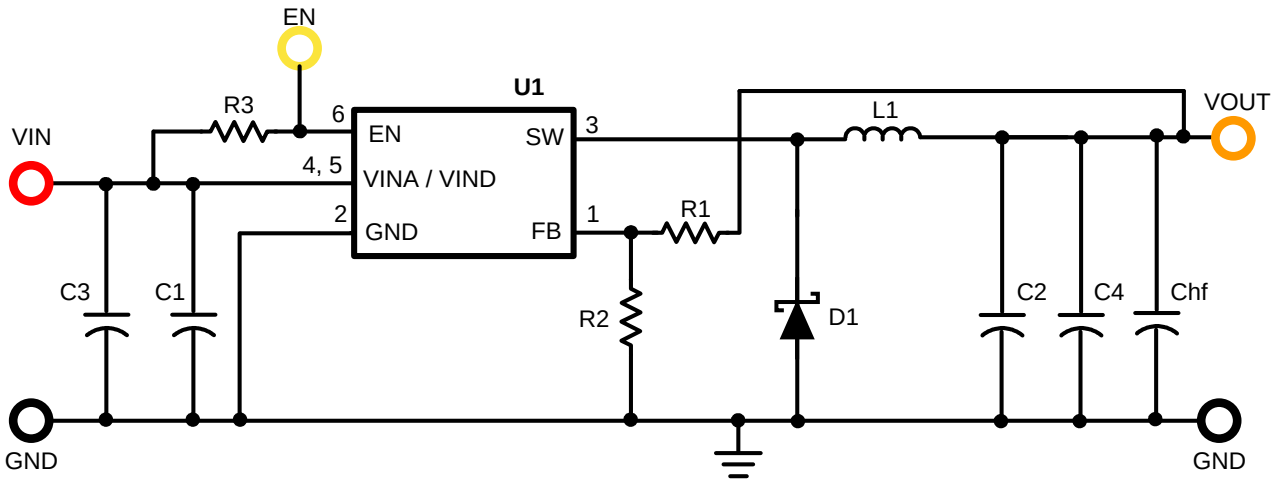



**Figure 2. LMR10510 Demo Board Schematic**

**Table 1. Bill of Materials LMR10510Y**

| Part ID | Part Value | Manufacturer | Part Number | Package Type |
|---|---|---|---|---|
| U1 | 1A Buck Regulator | Texas Instruments | LMR10510 | WSON |
| 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

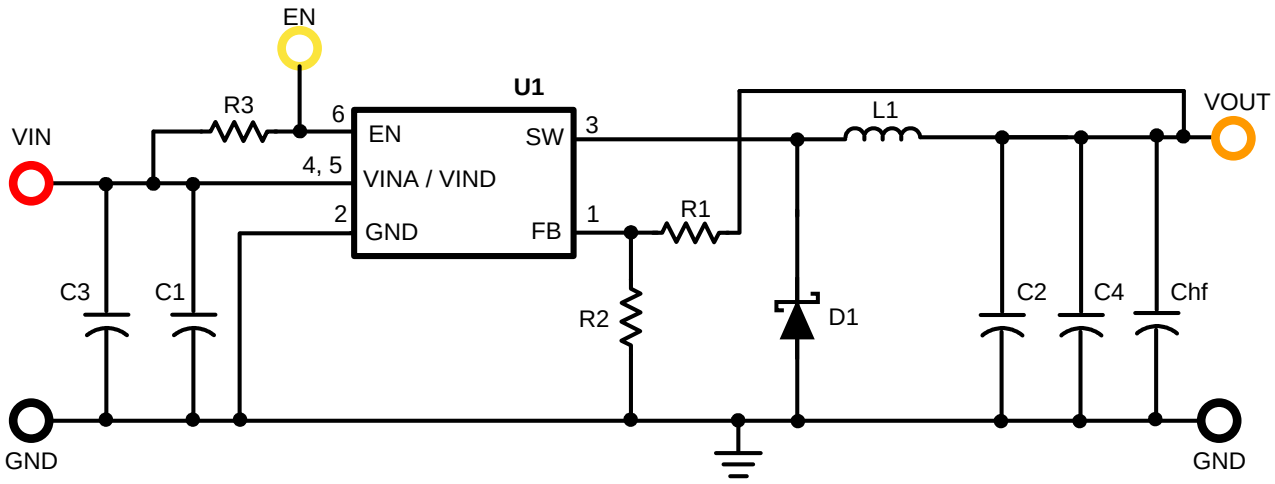



**Figure 3. LMR10515 Demo Board Schematic**

**Table 2. Bill of Materials LMR10515Y**

| Part ID | Part Value | Manufacturer | Part Number | Package Type |
|---|---|---|---|---|
| U1 | 1.5A Buck Regulator | Texas Instruments | LMR10515 | WSON |
| 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

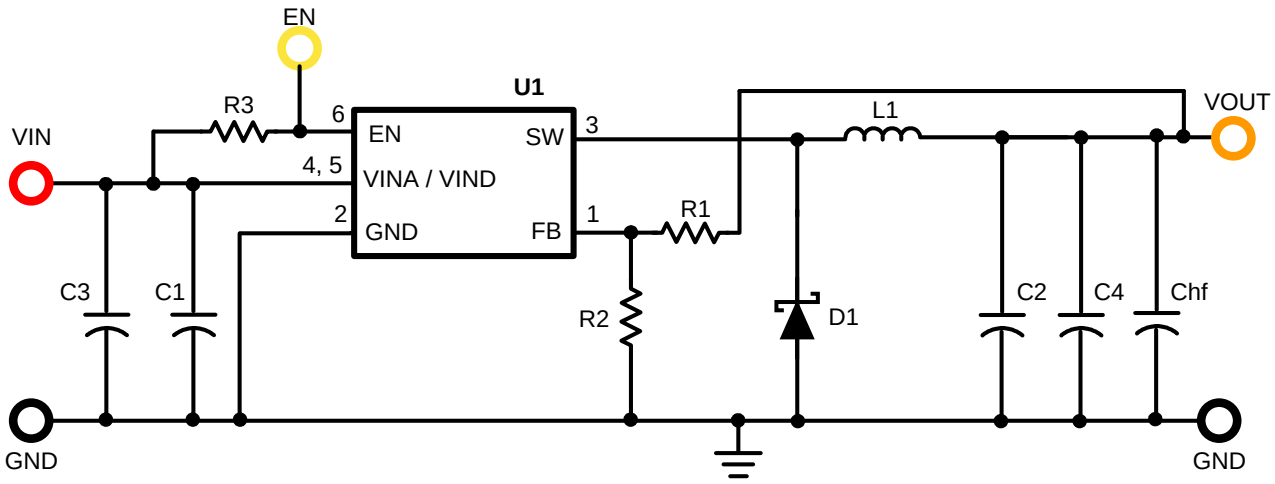



**Figure 4. LMR10520 Demo Board Schematic**

**Table 3. Bill of Materials LMR10520Y**

| Part ID | Part Value | Manufacturer | Part Number | Package Type |
|---|---|---|---|---|
| U1 | 2A Buck Regulator | Texas Instruments | LMR10520 | WSON |
| 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

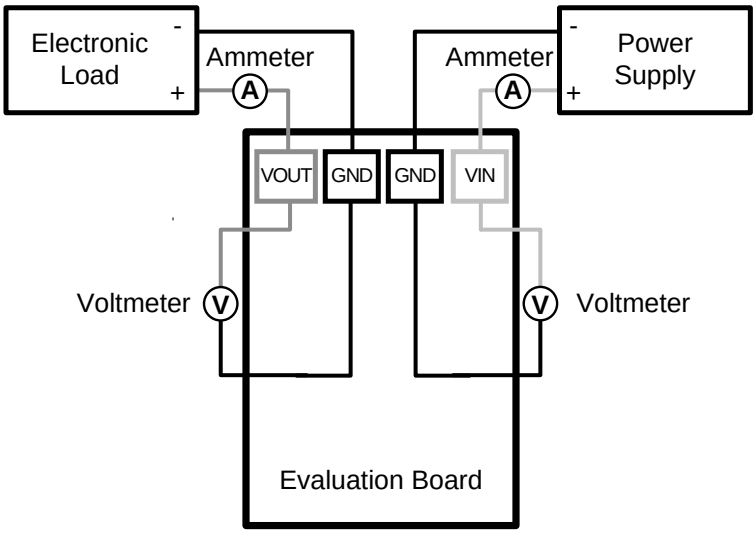



**Figure 5. Efficiency Measurements**

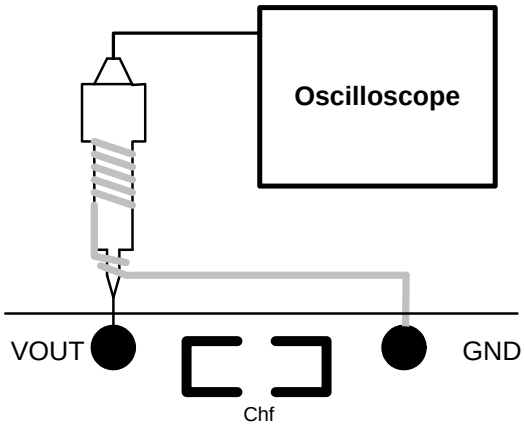



**Figure 6. Voltage Ripple Measurements**

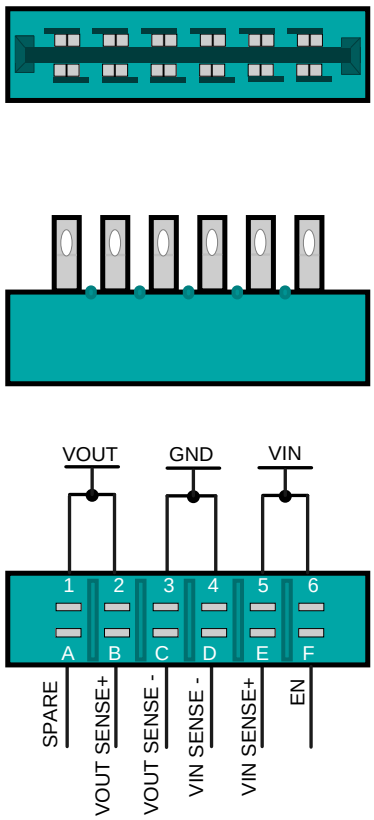
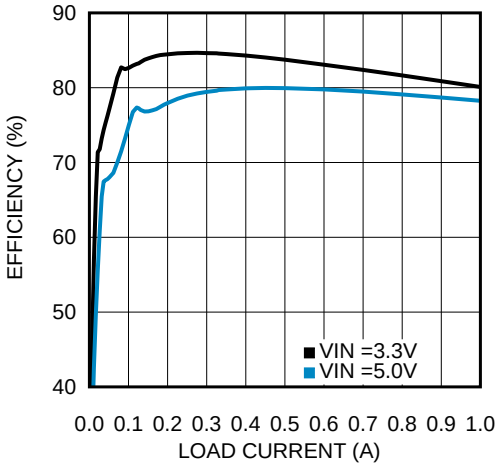


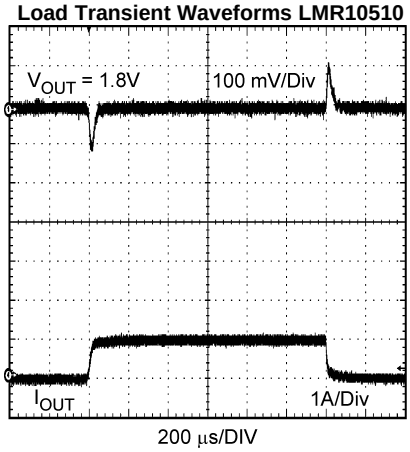

**Figure 7. Edge Connector Schematic**

## 10 Typical Performance Characteristics

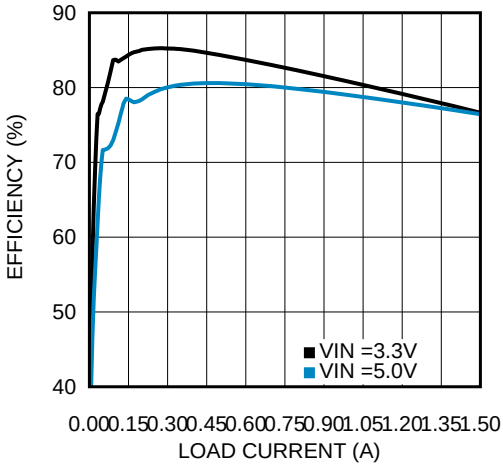
**Efficiency vs. Load Current LMR10510**



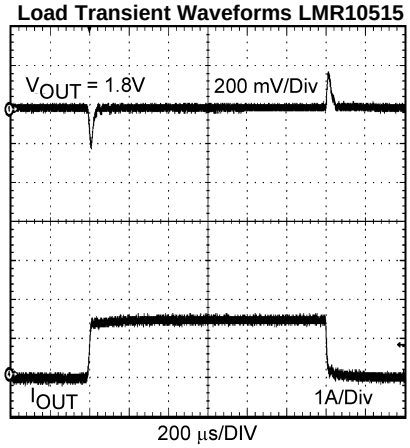

**Load Transient Waveforms LMR10510**



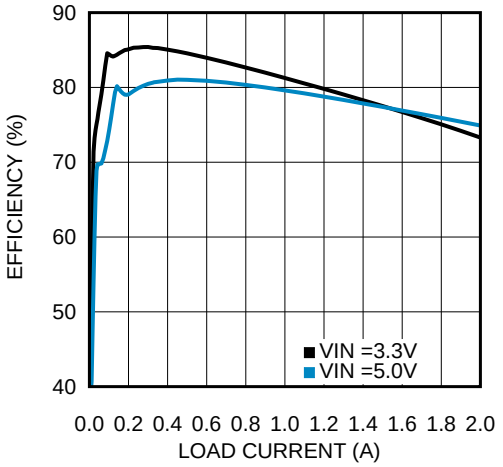

**Efficiency vs. Load Current LMR10515**



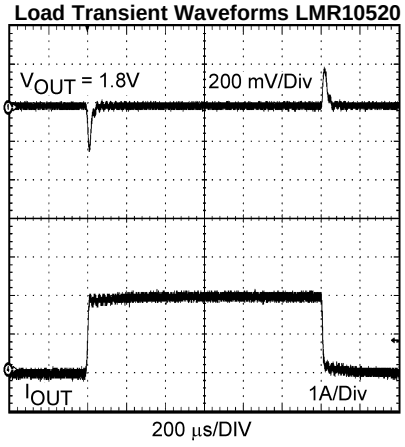

**Load Transient Waveforms LMR10515**



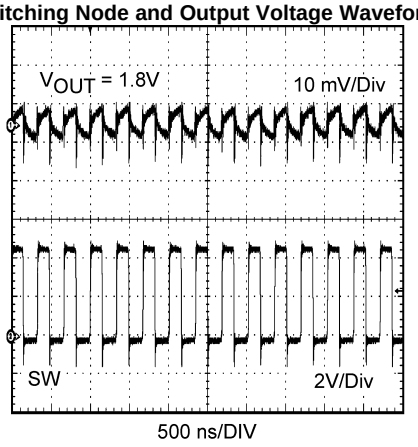

**Efficiency vs. Load Current LMR10520**



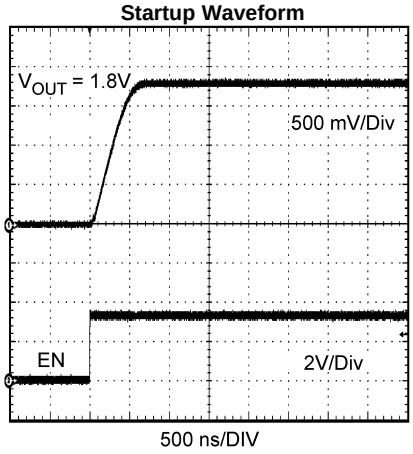

**Load Transient Waveforms LMR10520**



**Switching Node and Output Voltage Waveforms**




**Startup Waveform**



## 11 Layout

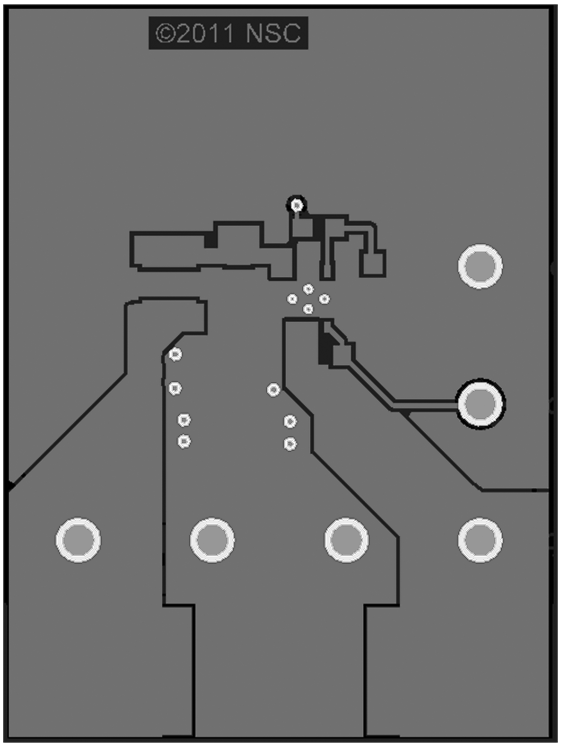



**Figure 8. Top Layer**

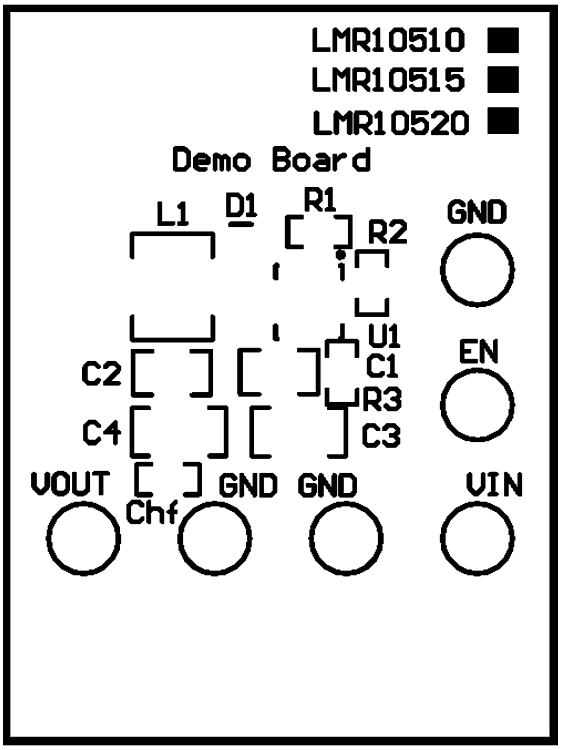



**Figure 9. Top Overlay**

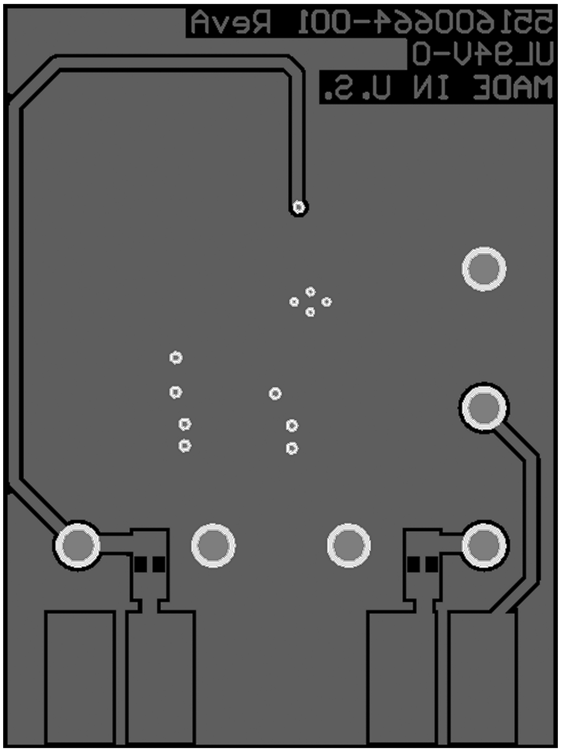


**Figure 10. Bottom Layer**

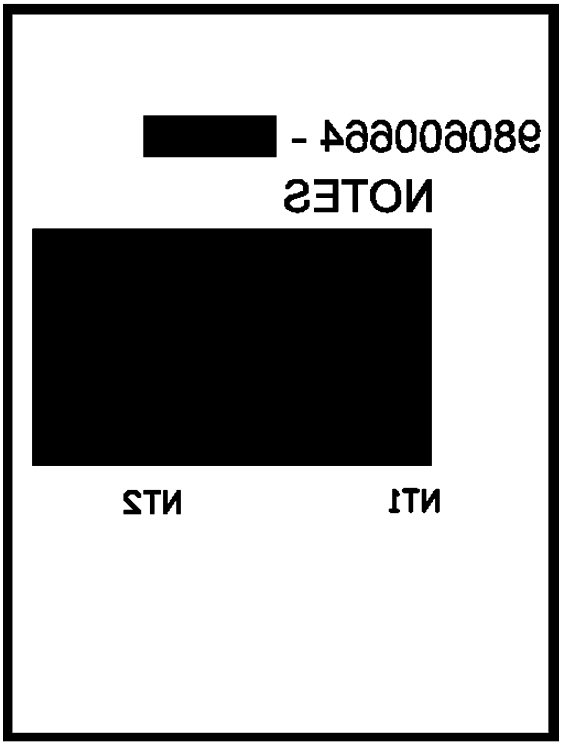



**Figure 11. Bottom Overlay**

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