Test Report
For PMP15013
05/12/2016

1. Design Specifications

Vin Min	**18VDC**
Vin Normal	**24VDC**
Vin Max	**36VDC**
Vout	**5VDC**
Iout	**3A**
Wide Vin DCDC Switching Frequency	**400kHz**

2. Circuit Description

The PMP15013 reference design is a 4-layer board 5V/3A output power supply using LMR16030 buck regulator for 24V bus in industry application. LMR16030 is a 4.5V to 60V input, 3A output capable, and 200 kHz to 2.5MHz non-sync buck regulator. This reference design has an input voltage range of 18V to 36V, covering the wide variation condition for the 24V bus in industry application. The reference board includes an input EMI filter section, and the layout is optimized for improved EMI performance on a 4-layers PCB. The board was tested under the Industry CISPR 22, and the conducted emissions (CE) and radiated emissions (RE) were compliance with the CISPR 22 Class B requirement with 10dB margin.

3. Board Photos

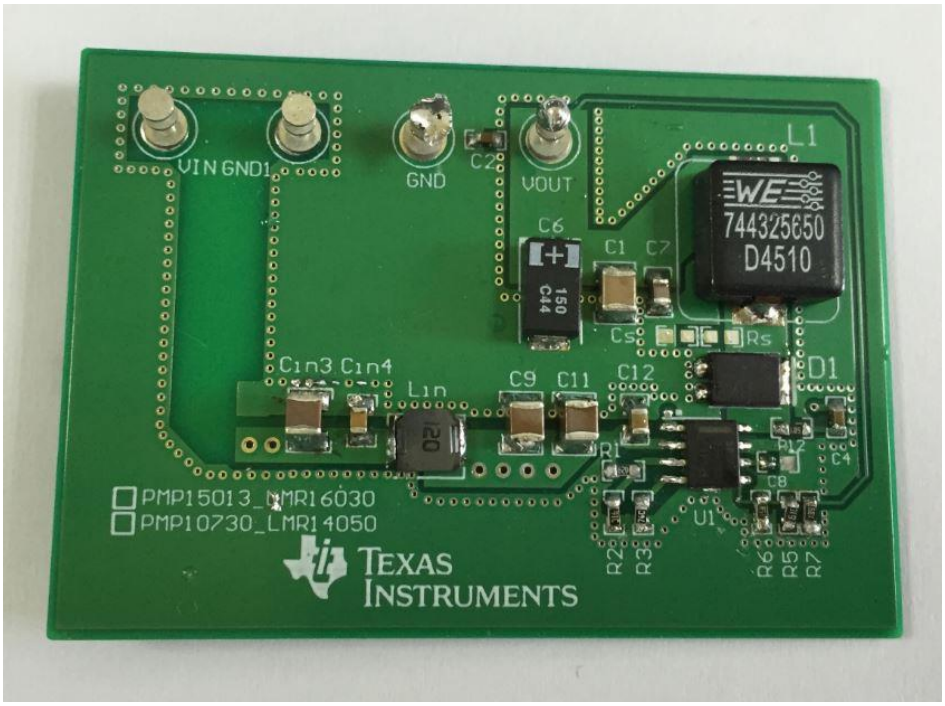


Figure 1. Reference Design Board Top View (61x42mm^2)

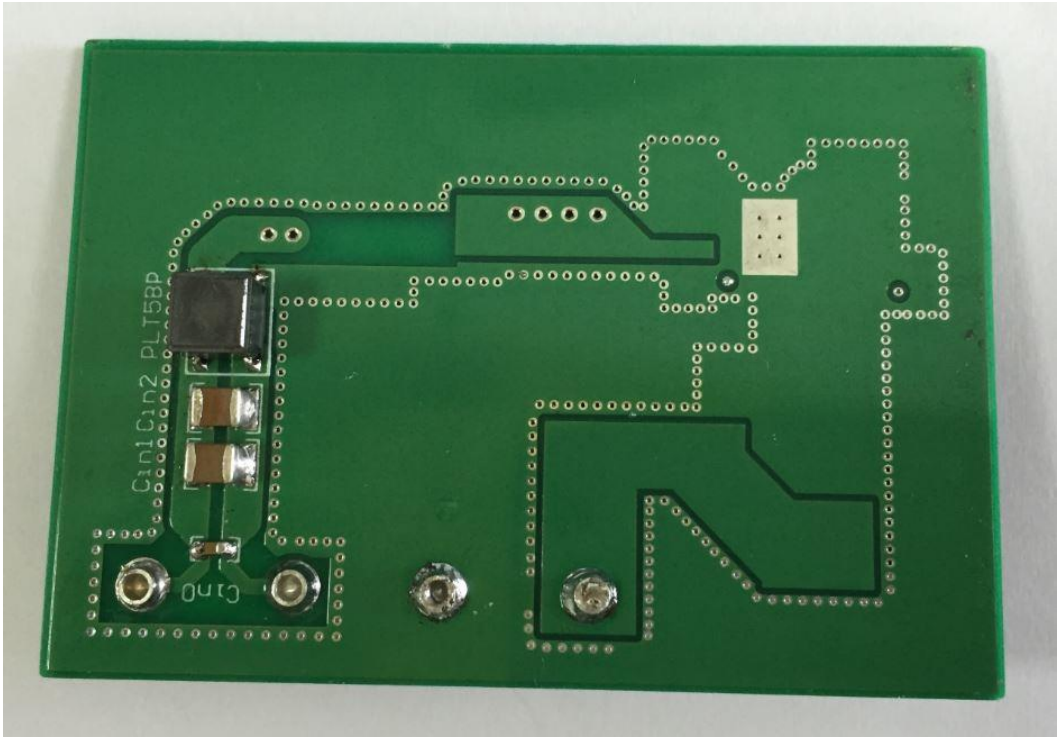


Figure 2. Reference Design Board Bottom View (61x42mm^2)

4. Efficiency and Load Regulation

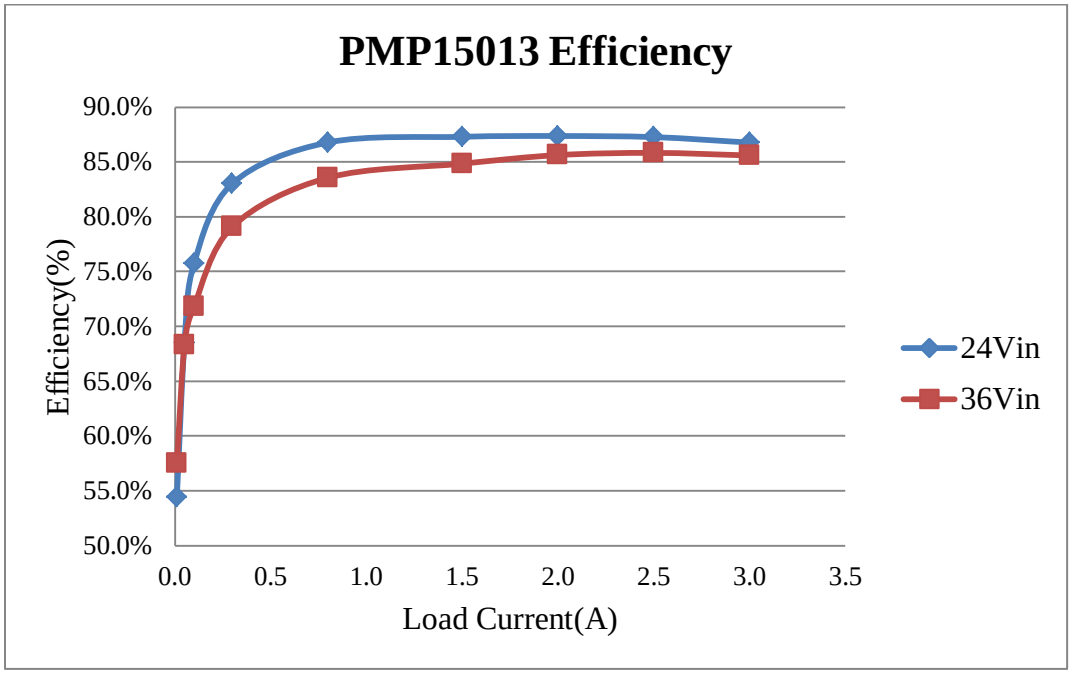


Figure 3. Power Efficiency with 24V/36V Input Voltage

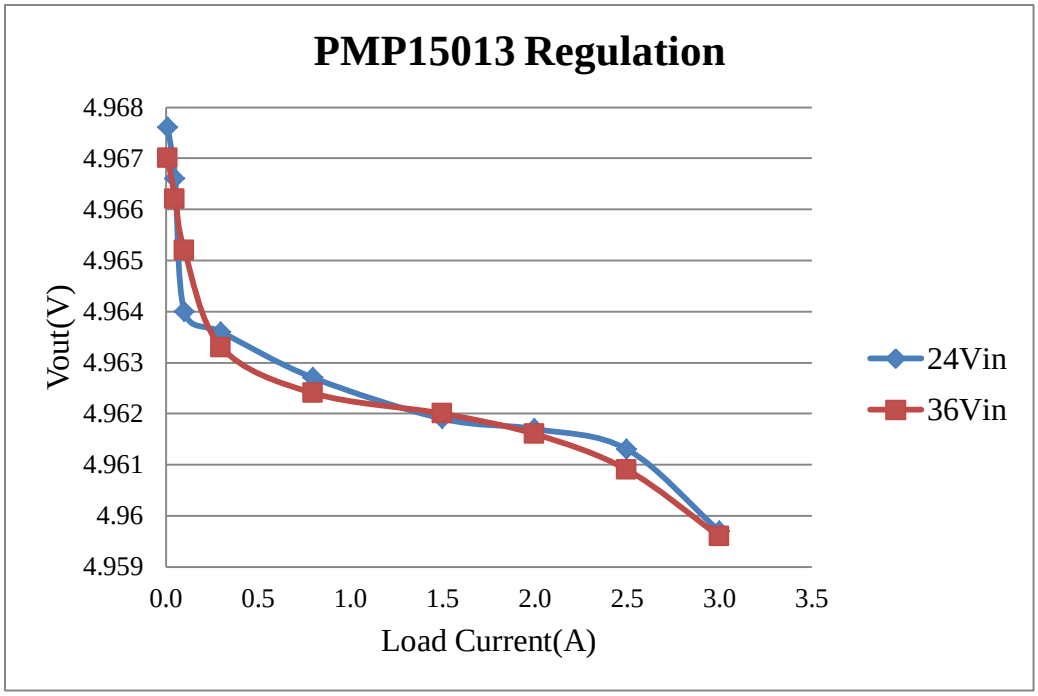


Figure 4. Load Regulation with 24V/36V Input Voltage

5. EMI Test

5.1 Test Setup

The conducted and radiated emissions were tested under the CISPR 22 standards. The test setup is shown in Figure 5 and Figure 6. A 24V input voltage was from 220VAC and three 5Ohm resistors were soldered on the output terminals of the test board as a 3A load.

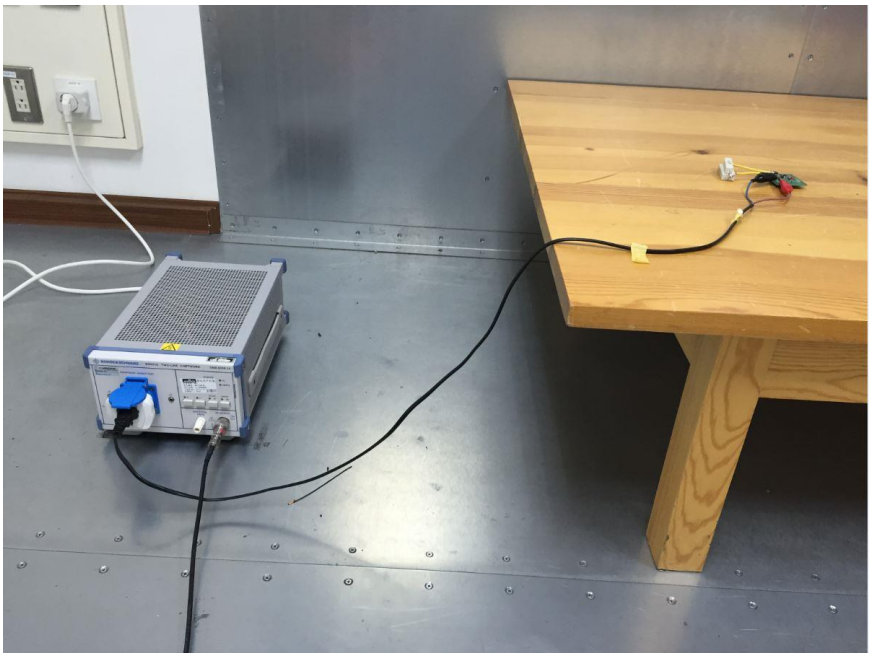


Figure 5. Conducted Emissions Test Setup

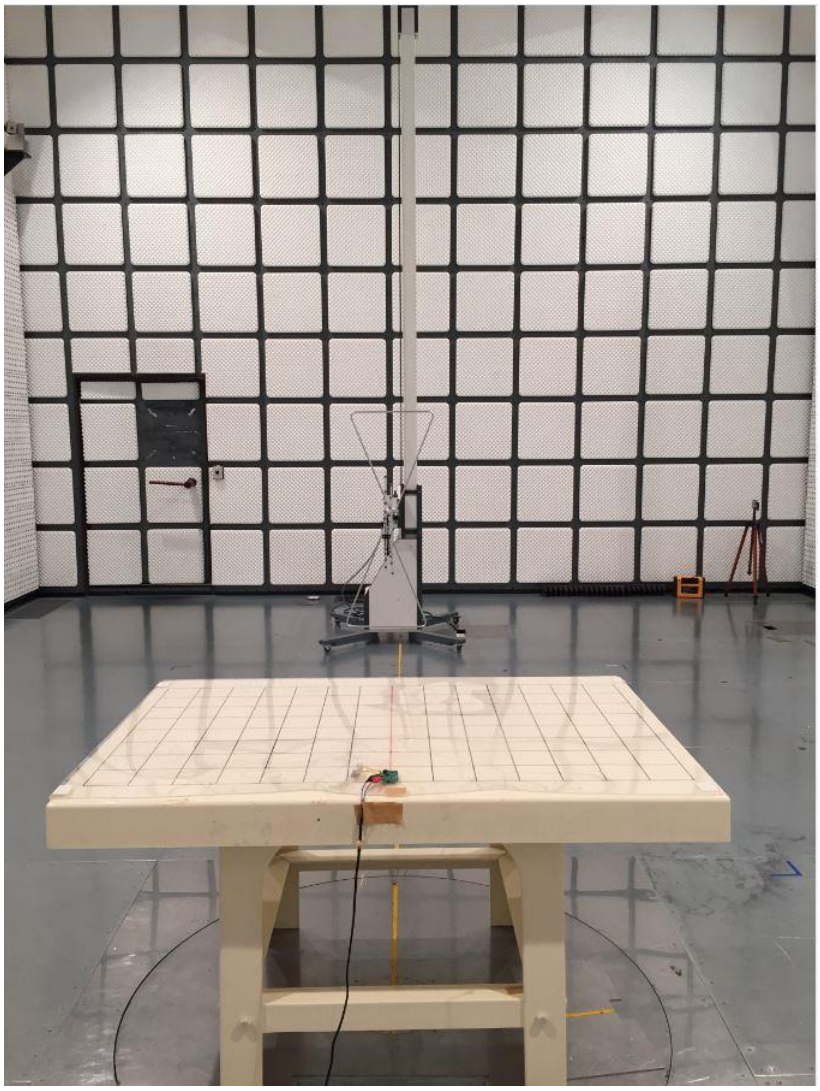


Figure 6. Radiated Emissions Test Setup

On the reference design board, the input EMI filter section (Figure 7) has a common mode filter stage and a differential mode filter stage. The common mode filter section is to further suppress the high frequency EMI noise (>30MHz) while the differential mode is to suppress the fundamental frequency or low-order harmonics. Both CE and RE were tested with and without the common mode filter. The test results show that the reference design board is compliance with CISPR 22 Class B with and without common mode filter (10dB margin). Adding the common mode filter has better CE performance at 30MHz. Note that all the other tests were done with the common mode filter.

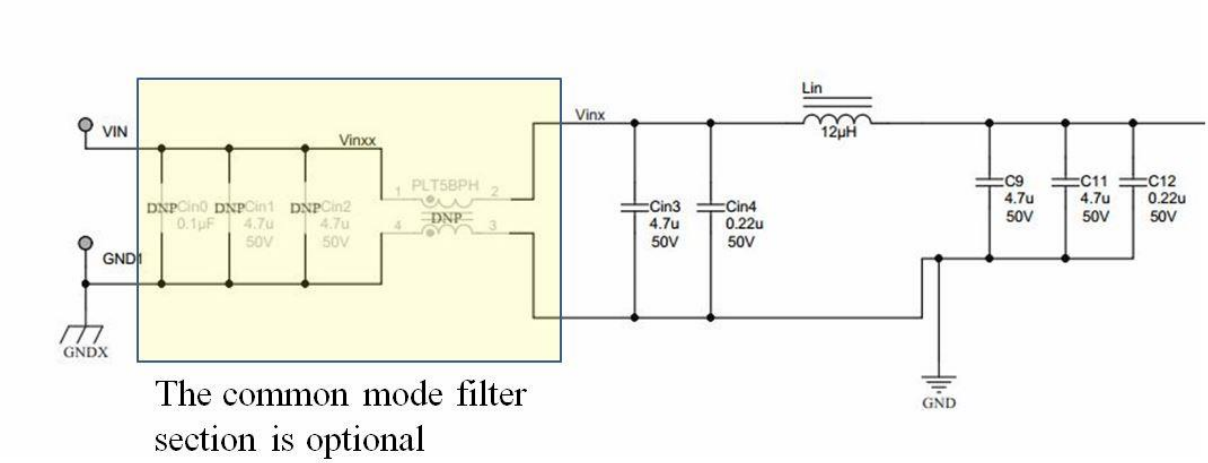


Figure 7. Input filter schematic

5.2 Test Results

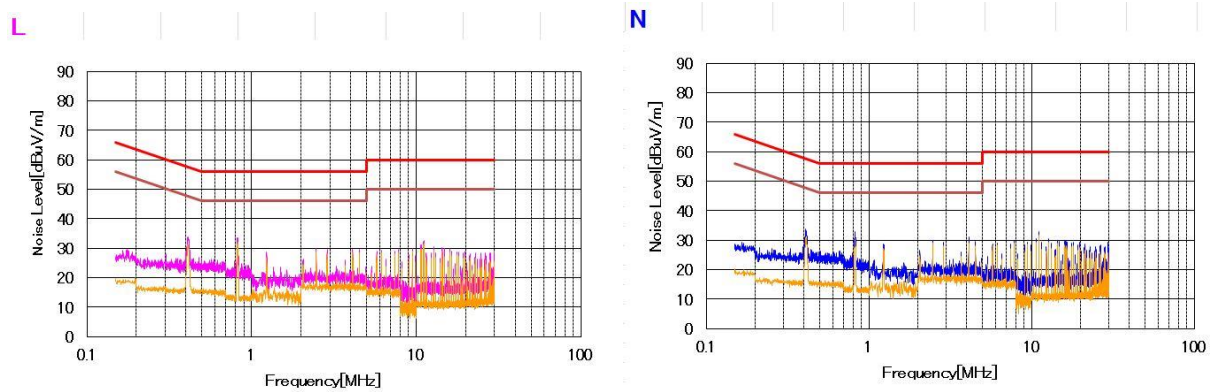


Figure 8. Conducted EMI scan, with common mode filter

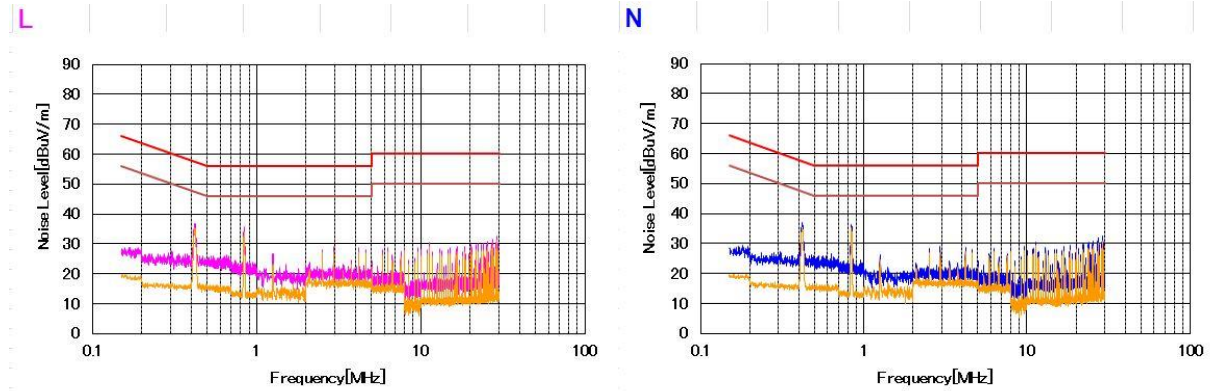


Figure 9. Conducted EMI scan, without common mode filter

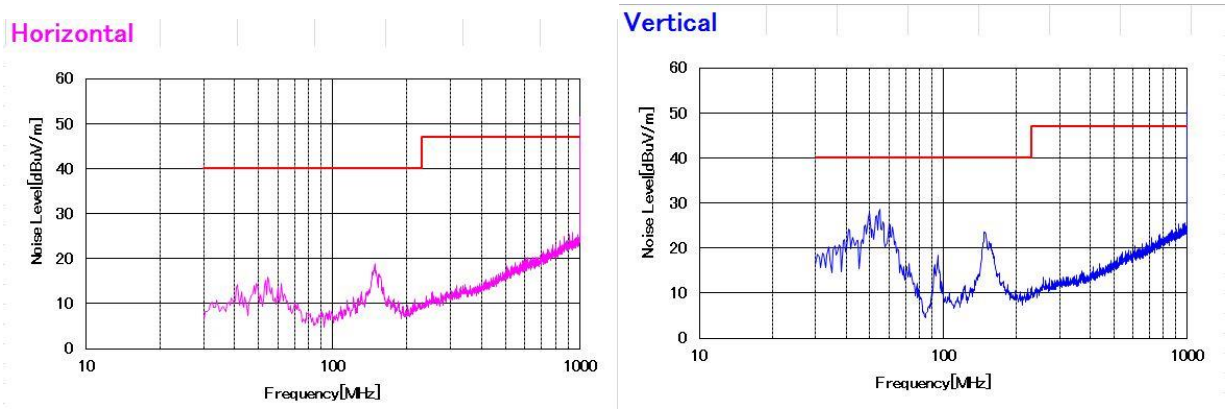


Figure 10. Radiated EMI scan, with common mode filter

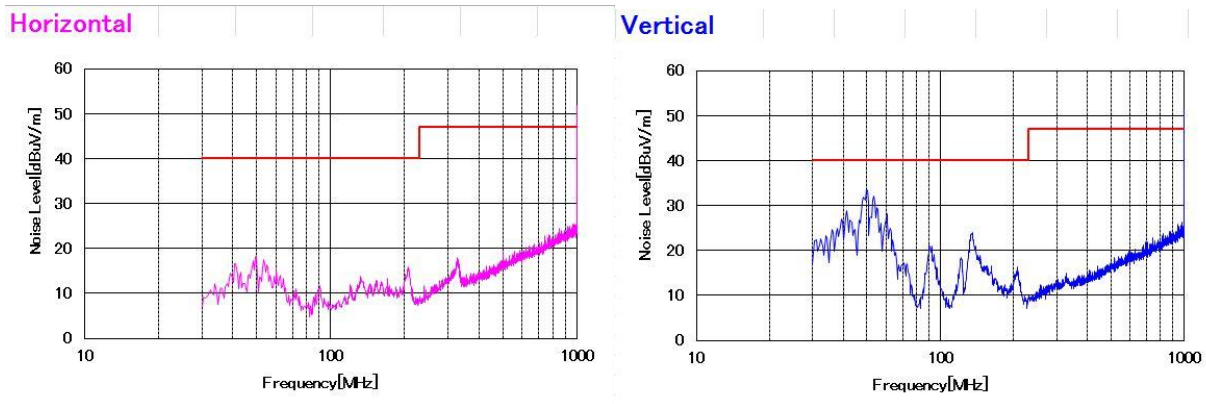
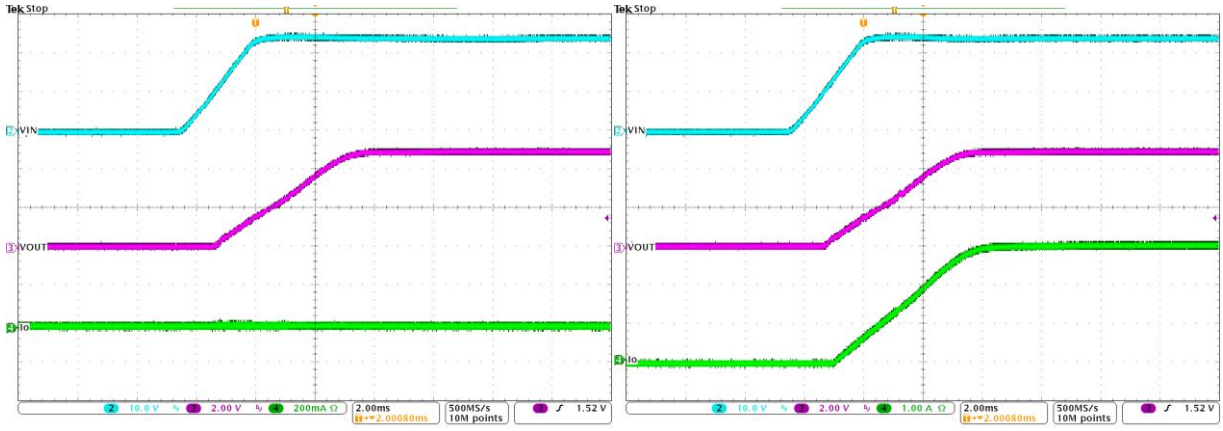


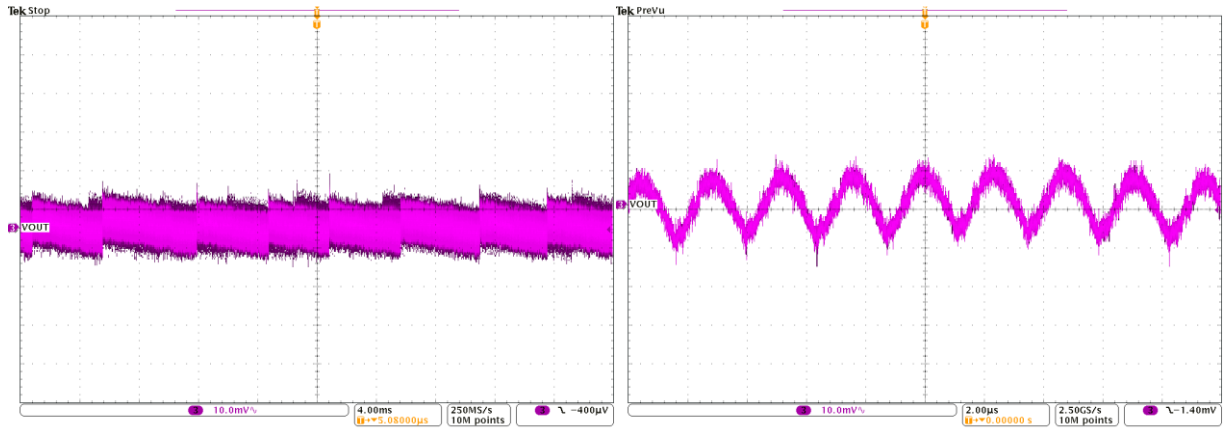
Figure 11. Radiated EMI scan, without common mode filter

6. Waveforms



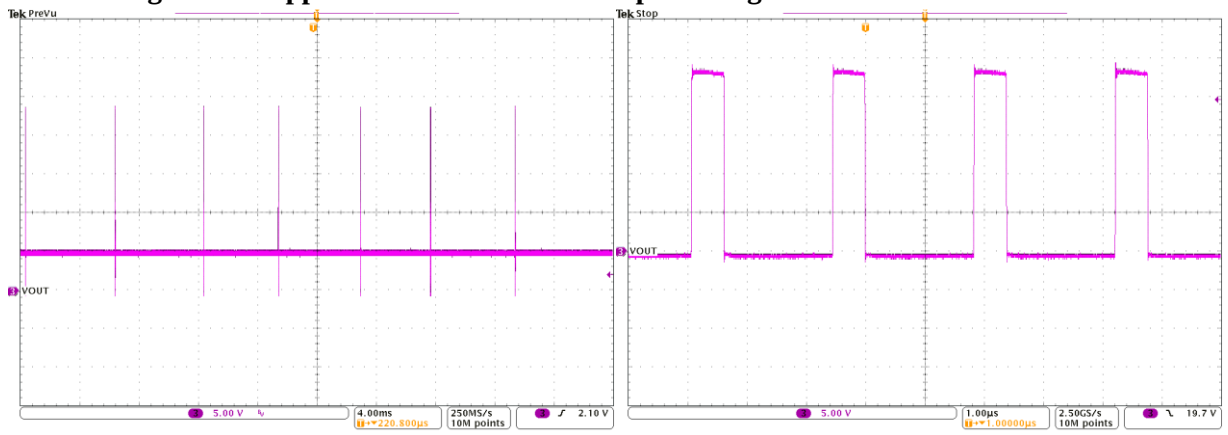
(a)V_{IN}=12V, no load (b) V_{IN}=12V, Io=3A

Figure 12. Start up waveforms with 12V input voltage and different load current



(a)V_{IN}=12V, no load (b) V_{IN}=12V, Io=3A

Figure 13. Ripple waveforms with 12V input voltage and different load current



(a)V_{IN}=12V, no load (b) V_{IN}=12V, Io=3A

Figure 14. Switching waveforms with 12V input voltage and different load current

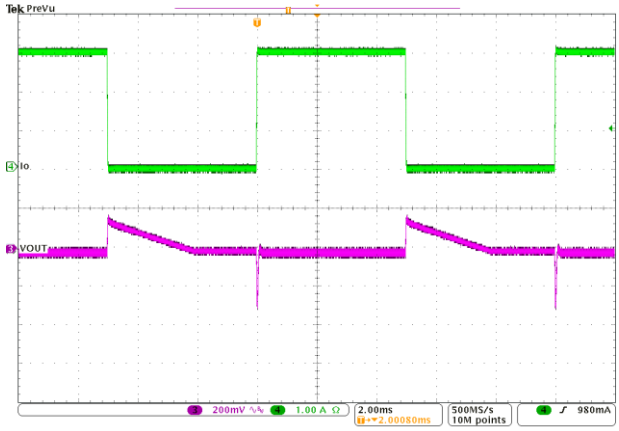


Figure 15. Load transient with 12V input voltage (0A-3A-0A, 0.1A/us)

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (https:www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265