Test Report
For PMP9300
10/10/2013

Overview

The reference design provides a power system solution to the Aptina AR0132 image sensors in automotive camera applications. The design comes with 2 20x20mm boards: one is the power board, and the other is the filter board. The power board has two synchronous buck regulators, LM34919C and TPS62231, to generate 1.8V and 2.8V outputs to cover the core, analog and I/O supply of the image sensor IC. The input voltage range is 4.5V to 50V suitable for 12V automotive battery supply. On the power board, the output filter design ensures good image quality by reducing the output voltage ripple and noise, while meeting the power-up sequencing requirement. The power board also has an optional input filter stage to suppress the conducted emissions on power lines, making the power board along a complete power supply solution for the image sensor as seen in Figure 1.

The filter board is designed to enable transferring power and FPD-Link III over a single coax cable. In this configuration, the image signal can continually transmit as the FPD-Link III signal through the coax cable, while the power is inductively coupled to the same cable to supply the whole system. On the filter board, the coupling inductors, capacitors, filtering components and the connectors are implemented for both the Serializer and Deserializer side. The filter board and power board connection is shown in Figure 2. Also, there is an optional input power filter same as the one on power board if the power-over-coax setting is not desired.

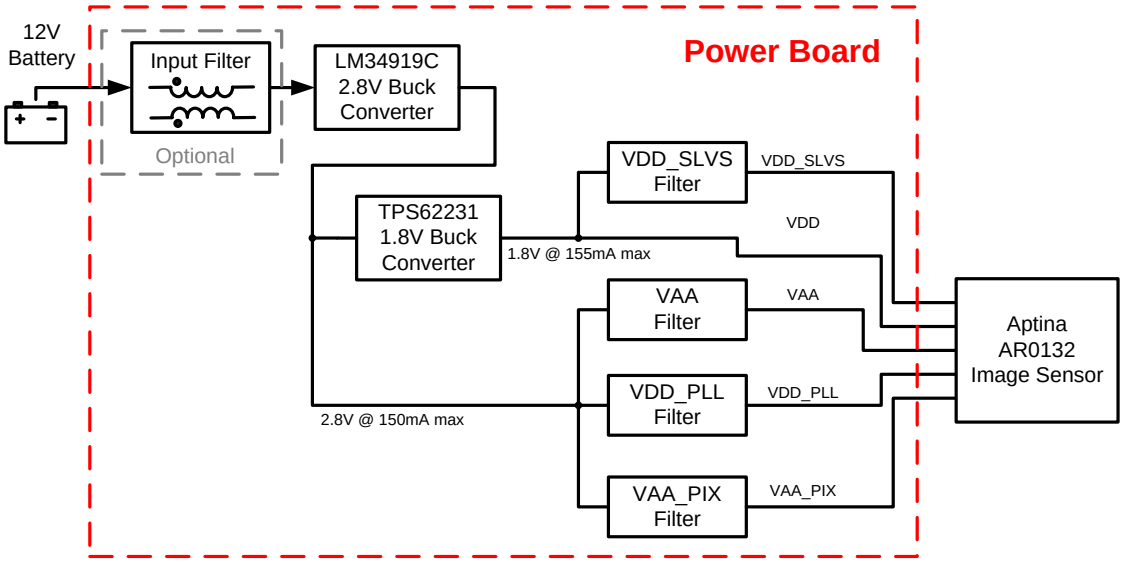


Figure 1

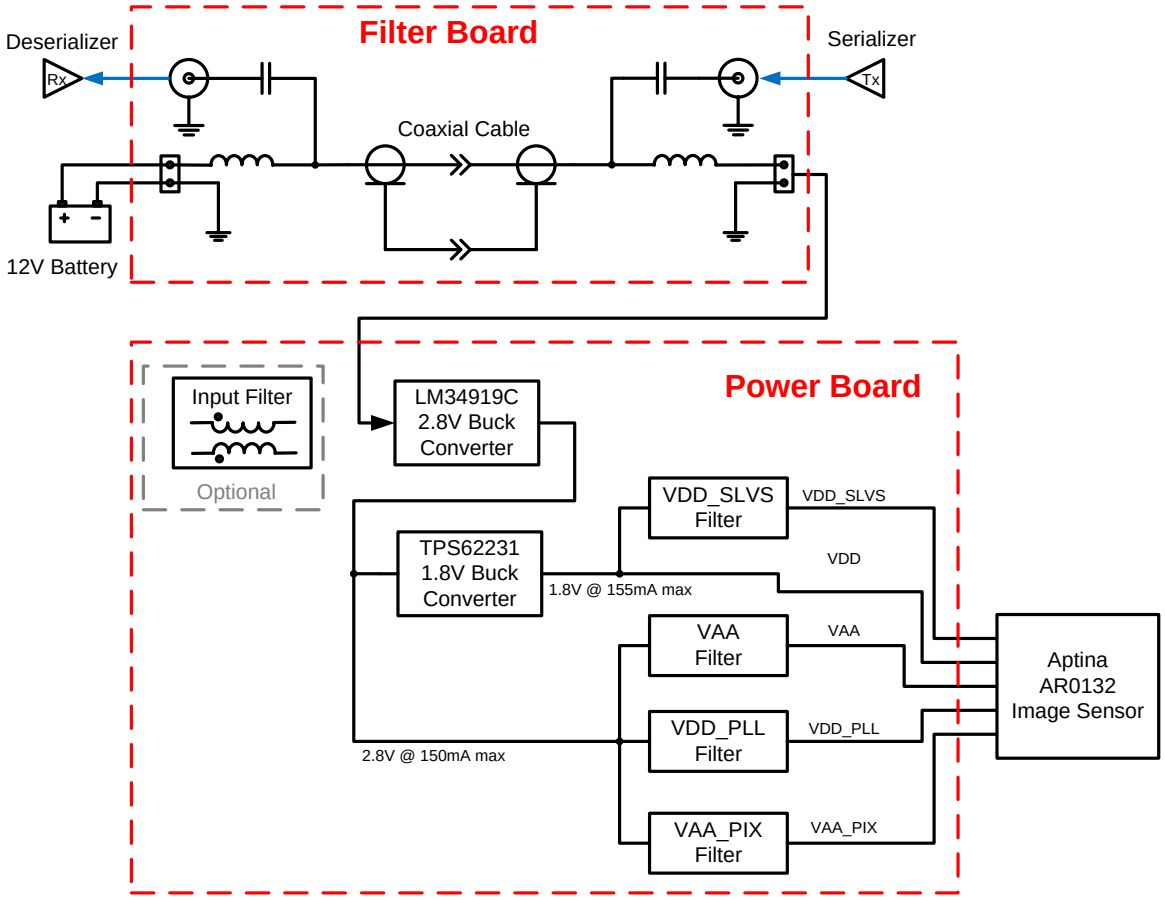


Figure 2

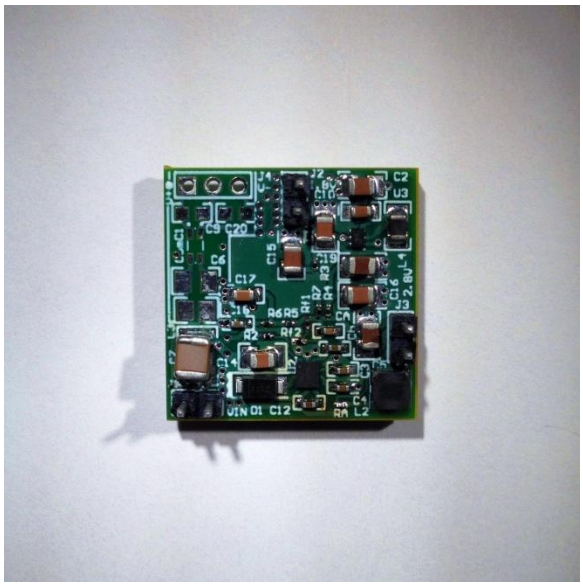
Power Specification

Vin range: 4.5V – 50V

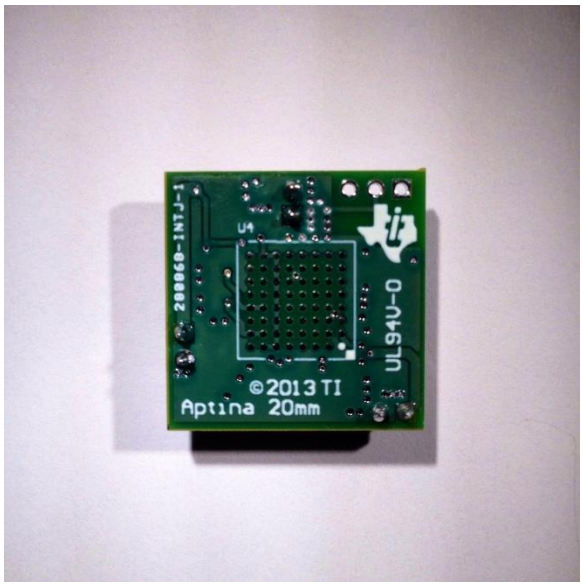
Nominal Vin = 12V

Outputs: 1.8V@155mA, 2.8V@150mA

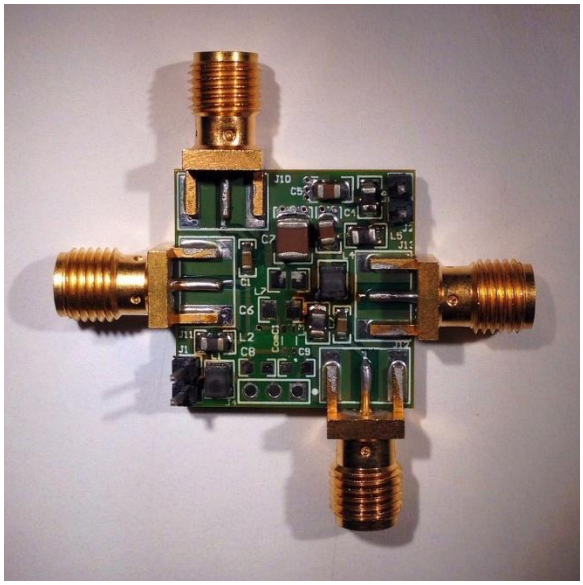
Board Photos



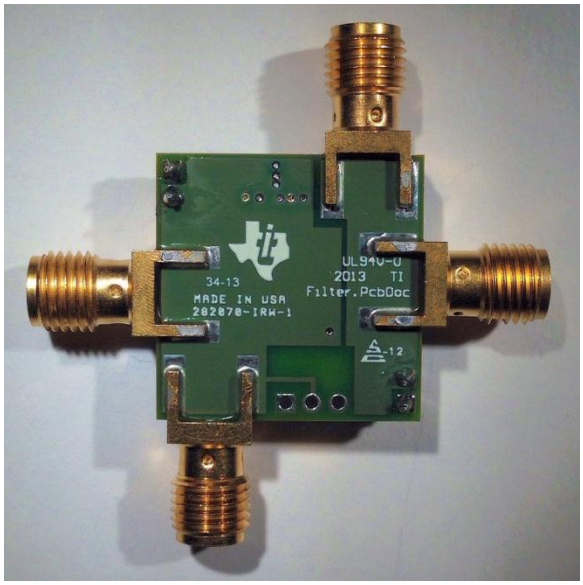
Power Board Front



Power Board Back



Filter Board Front



Filter Board Back

Figure 3

Size: 20x20mm

Efficiency

The efficiency is measured separately for the 1.8V and 2.8V output.

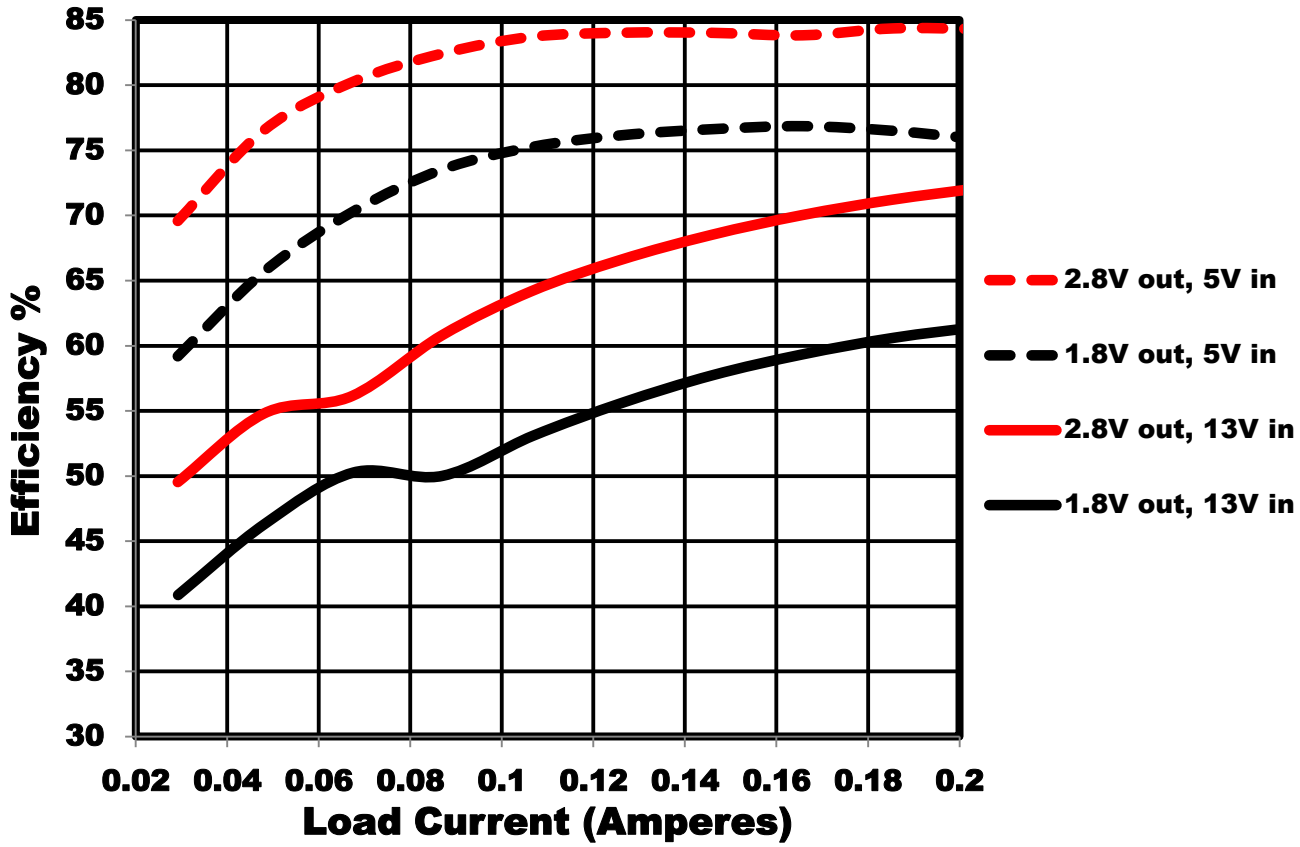


Figure 4

Load Dump

The load dump test simulates the condition that the battery disconnects from the alternator causing high input voltage surge. The automotive electronic device should be protected from such condition. In this load dump test, a 50V 80ms voltage pulse is applied to the input power line. As the LM34919C is a 60V device, the power supply continues its normal operation under the surge; a 140mV overshoot on the 2.8V output can be seen, but it stays in the Aptina spec requirement.

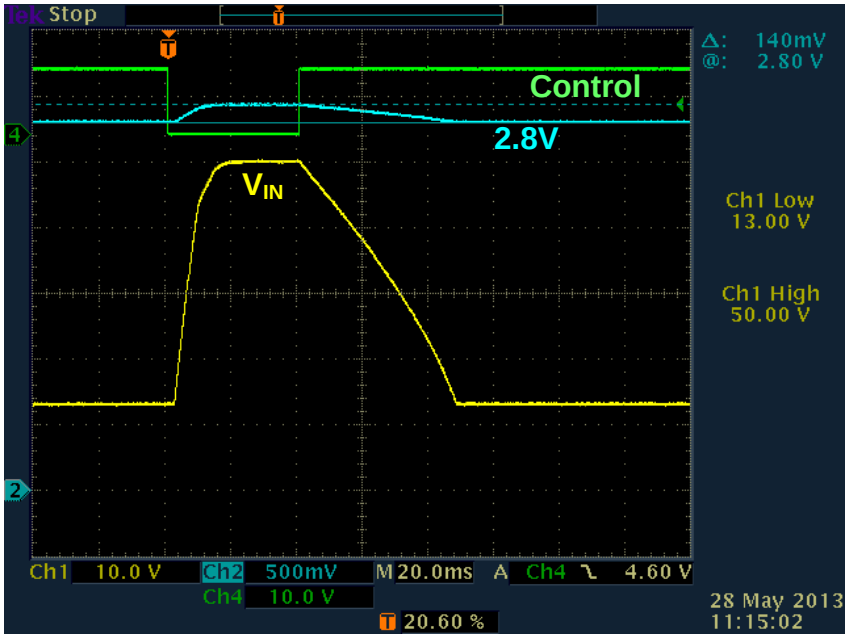


Figure 5

Conducted Emissions

The conducted emissions is tested followed the of CISPR 25 standards. The frequency band examined spans from 150 kHz to 108 MHz covering the AM, FM radio bands, VHF band, and TV band specified in the CISPR 25.

The test setup is shown in Figure 6.

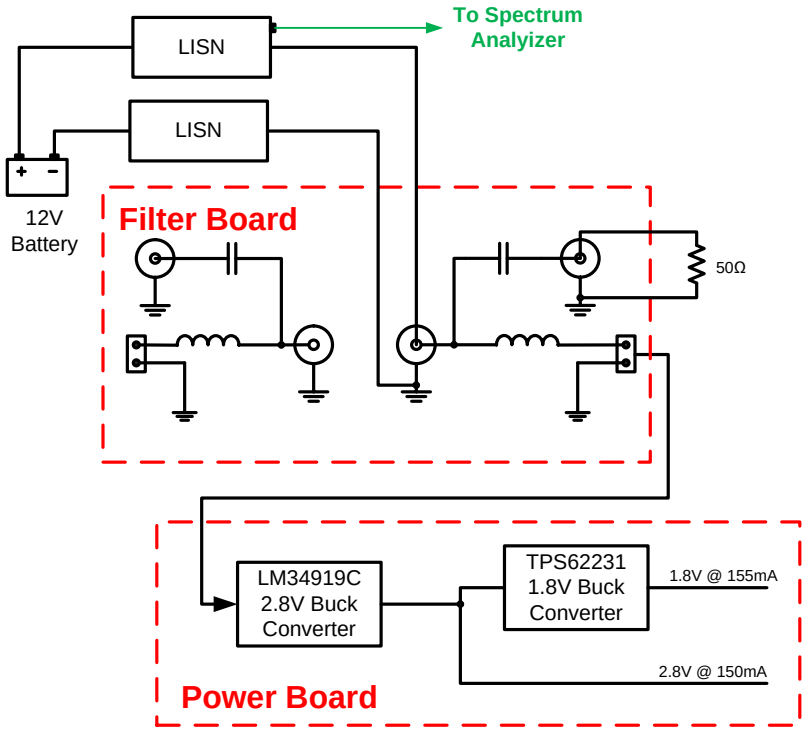


Figure 6

The test results are shown in Figure 7 and Figure 8. The limit lines shown in red are the Class 5 average limits for conducted disturbances specified in the CISPR 25; the yellow trace is the peak detector measurement, and the cyan trace is the average detector measurement. It can be seen that the power supply operates quietly and the noise is below the Class 5 limits.

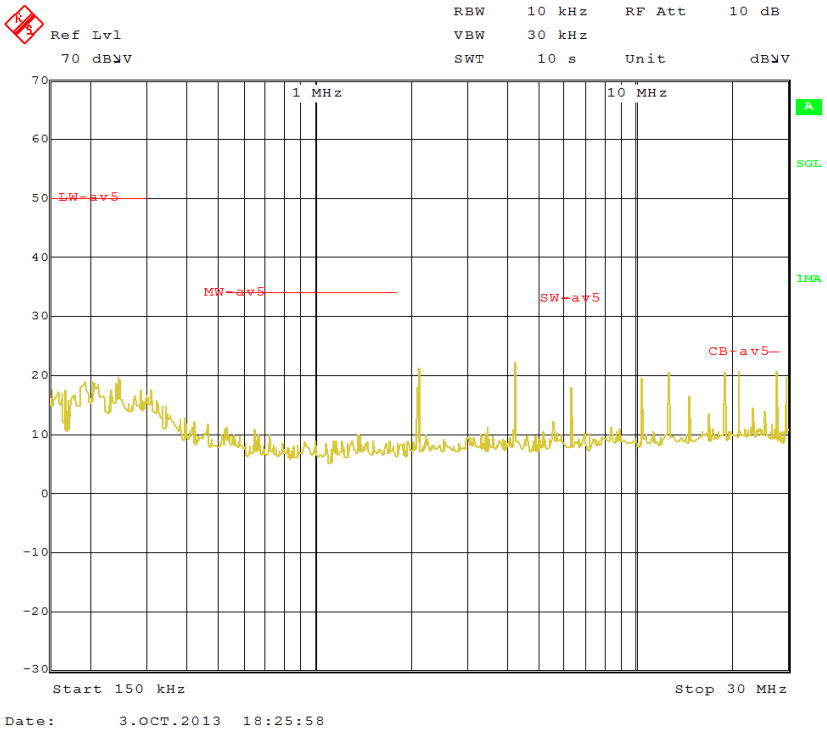


Figure 7

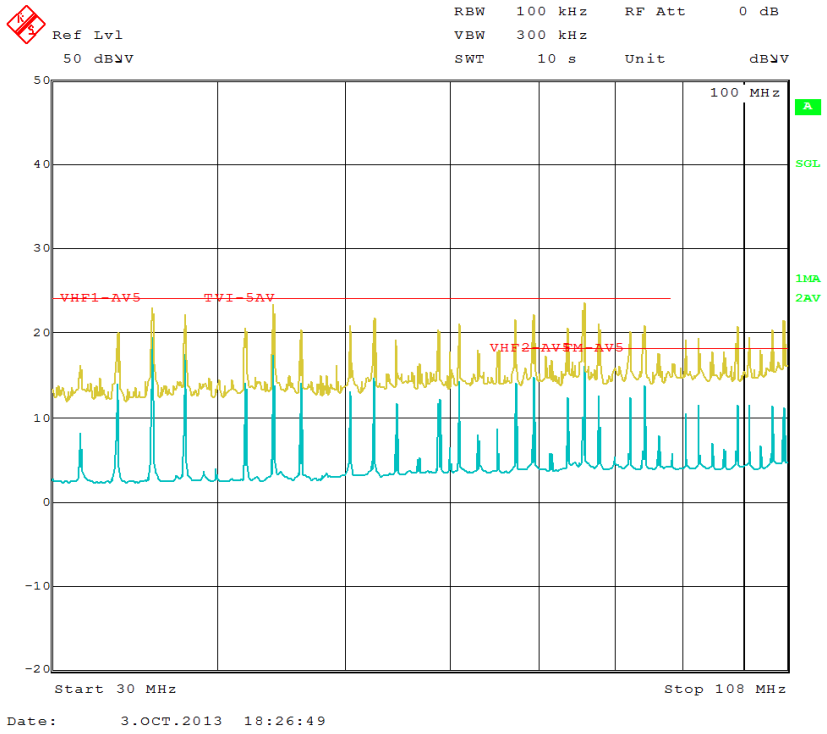


Figure 8

To monitor the noise on the FPD-Link signal, the spectrum analyzer is connected to the Serializer port on the filter board (see Figure 9). The results (Figure 10, Figure 11) show the disturbance to the signal port is minimal and the noise is well below the Class 5 limits.

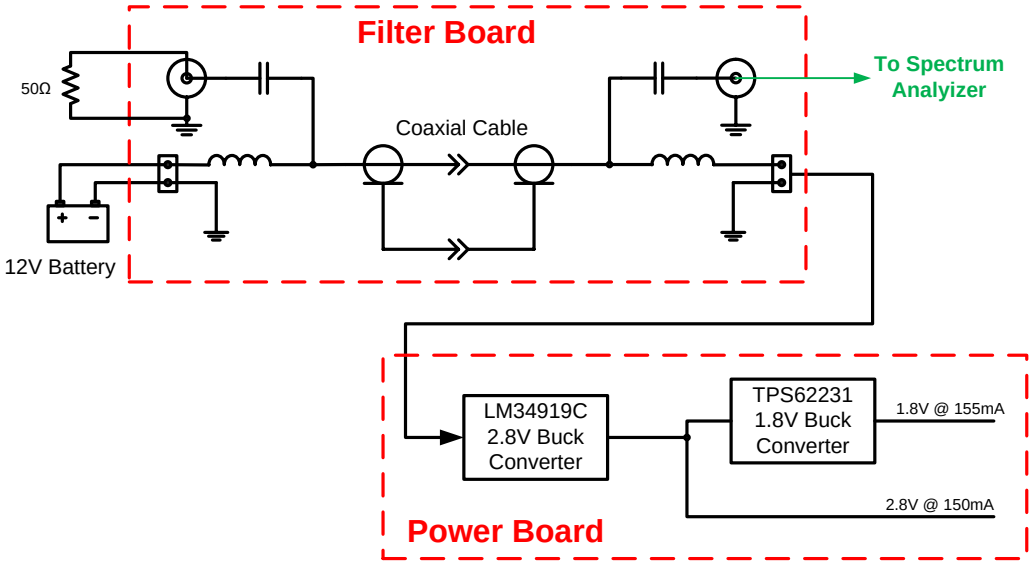


Figure 9

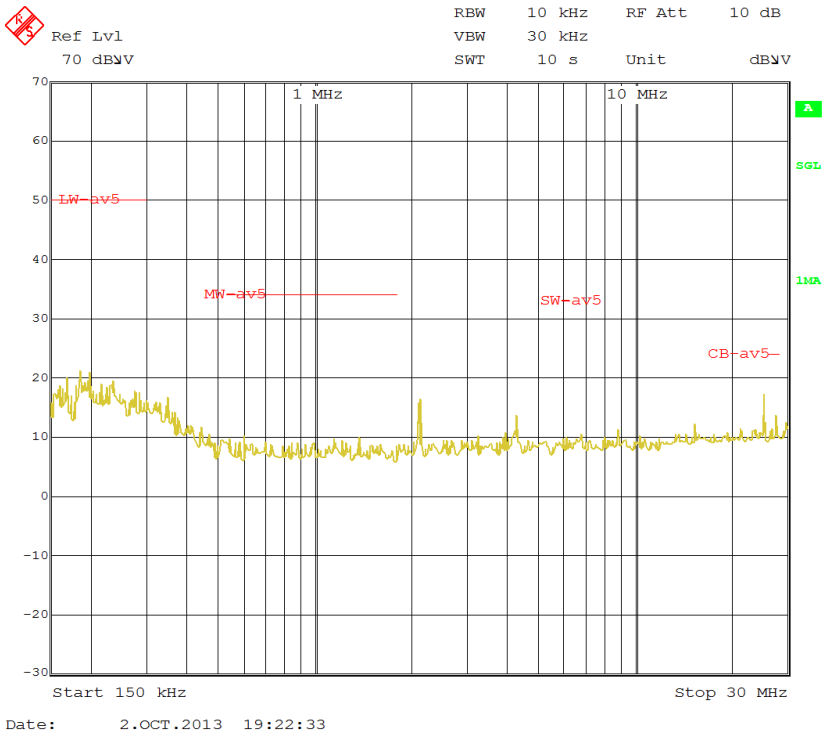


Figure 10

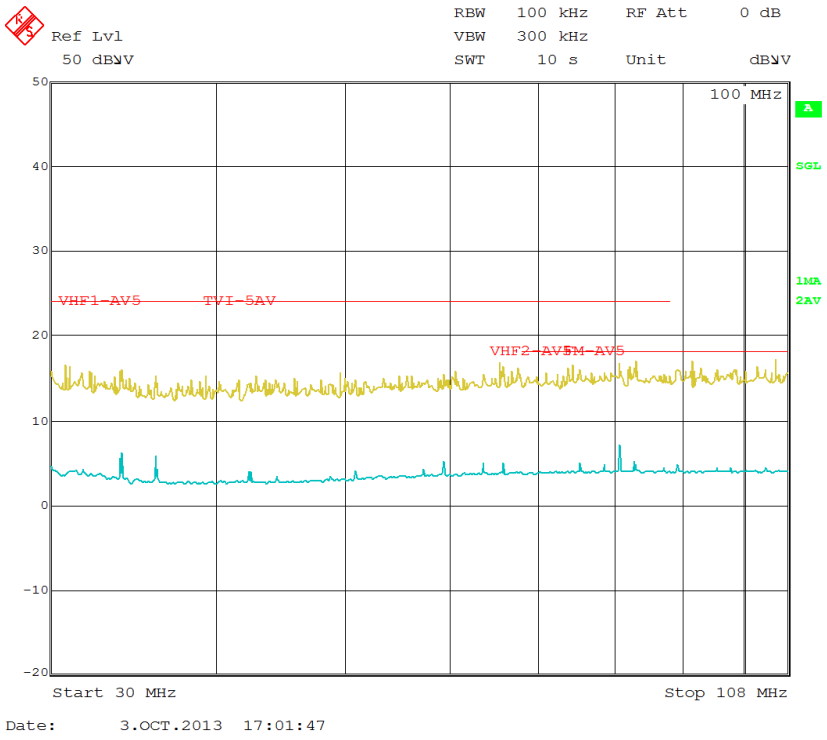

RBW 100 kHz
RF Att 0 dB
VBW 300 kHz
Ref Lvl
50 dBµV
SWT 10 s
Unit dBµV
100 MHz
A
SGL
1MA
2AV
VHF1-AV5
TVI-5AV
VHF2-AV5M-AV5
50
40
30
20
10
0
-10
-20
Start 30 MHz
Stop 108 MHz
Date: 3.OCT.2013 17:01:47

Figure 11

Output Filter Design

The image sensor is sensitive to the power supply ripples which could induce image artifacts and noise. Hence, RC filters are designed to provide adequate ripple attenuation protecting the sensitive output rails, while keeping minimal power dissipation.

For Aptina AR0132, the sensitive rails are the 2.8V supplies, VAA and VAA_PIX; VDD_PLL is also filtered as a precaution. The target attenuation is 40dB at around 2MHz for all three outputs, which brings ripple at the image sensor down to 100uV range, i.e. 40dB under any observed sensor noise thresholds. A 2 pole filter was employed for the VDD_PLL supply to make it come up first ensuring the power sequencing requirement. The RC filter circuit for each rail is shown in Figure 12, and the filter frequency and transient response simulation is in Figure 13.

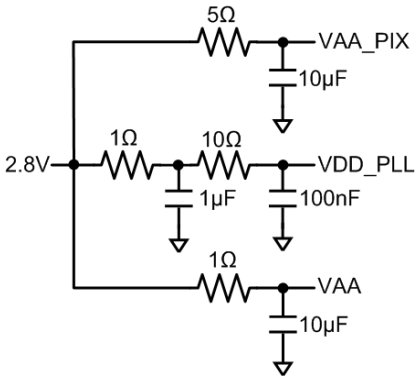


Figure 12

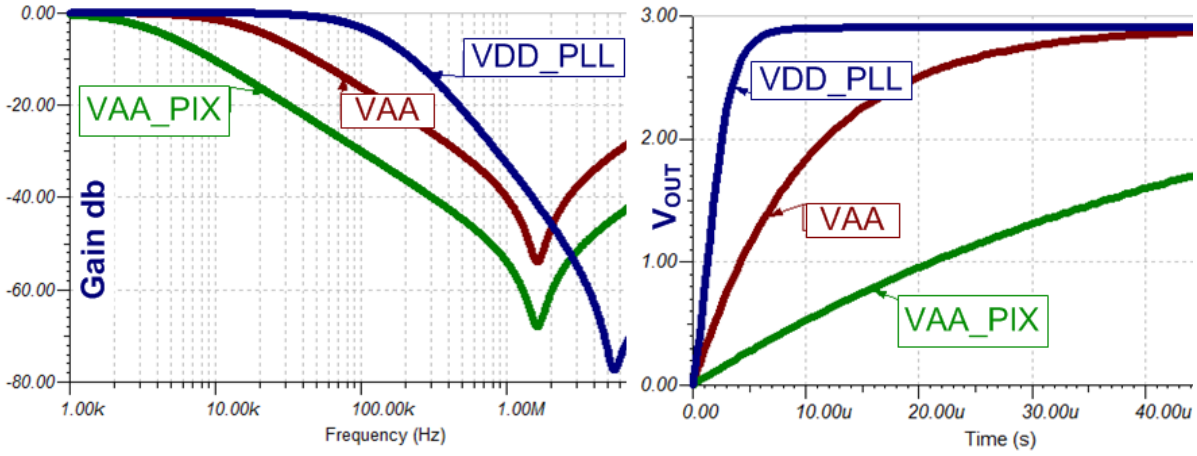


Figure 13

Switching Waveform

Figure 14 shows the switching waveform of the LM34919C and TPS62231 at full load condition and 13V Vin. The LM34919C is switching at 2.11MHz (ch1, yellow trace), and the TPS62231 is switching at 1.87MHz (ch2, green trace).

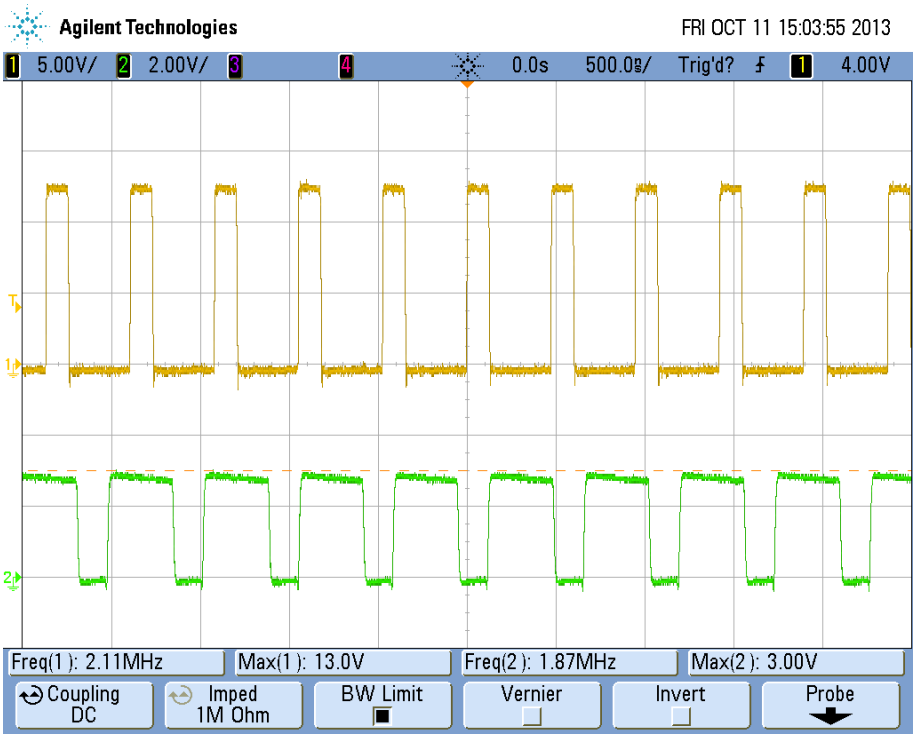


Figure 14

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