ON Semiconductor

Design Note – DN05111/D

AS0260 Image Sensor with Power & Clocking Reference Design

Device	Application	Output Voltage	Output Current	Dropout Voltage	Package
NCP163	Image Sensor	2.8 V & 1.8 V	250 mA	80 mV	WLCSP

Other Specifications

- Fully integrated image sensor module with power and clocking solution
- Supports a single wide input voltage
- Image sensor performance impervious to system design
- 9.5mmx9.5mm image sensor section

Introduction

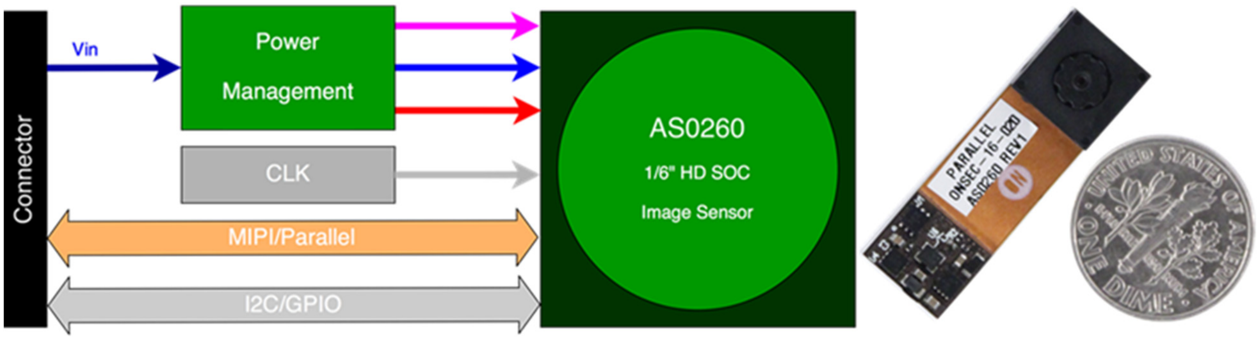
Complementary metal-oxide semiconductor (CMOS) imaging sensors are the most commonly used type of image sensors actually. One of the great advantages of CMOS sensors over charged coupled devices (CCDs) is the very high level of product integration, such as the possibility to include the timing logic, image digitalization and processing plus capture control on a miniature single chip. This reduces system power, cost, and size without much compromise in performance.

On the other side, CMOS imaging sensors are sensitive to noise, which can be electromagnetic interference (EMI), substrate noise coupling, thermal noise and power supply ripple. First three effects can be significantly reduced by proper circuit and PCB design. We will focus on power supply ripple only in this design note.

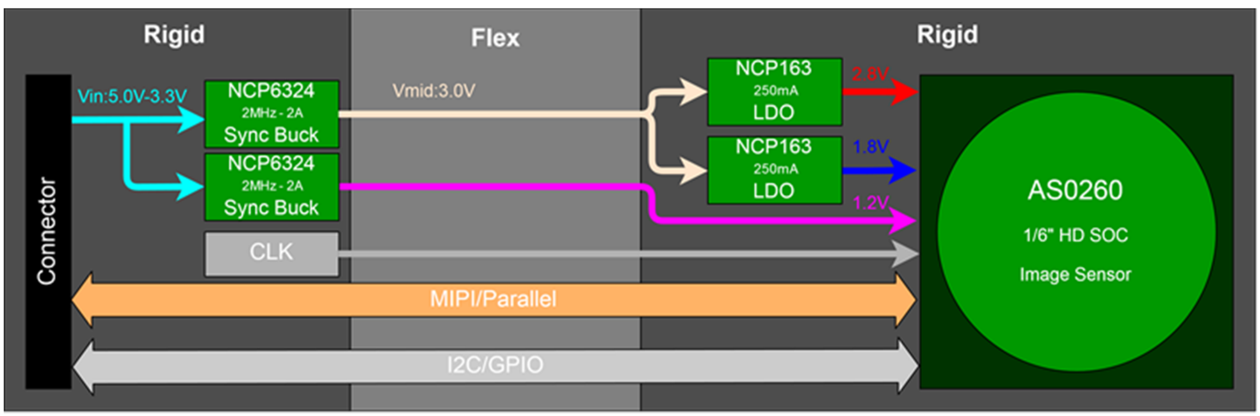
Voltage ripple present on digital supply rails usually does not cause any significant impact to image quality, while ripple is inside required and specified limits. On the other side, ripple present on analog supply rail is directly proportional to image quality and can cause several types of image distortion, including image noise.

In this design note we want to focus on AS0260 image sensor, which use two voltage supply rails: 2.8V for analog circuits and 1.8V for digital circuits. There is also another voltage level 1.2V used for communication interface (serial or parallel).

Circuit Description

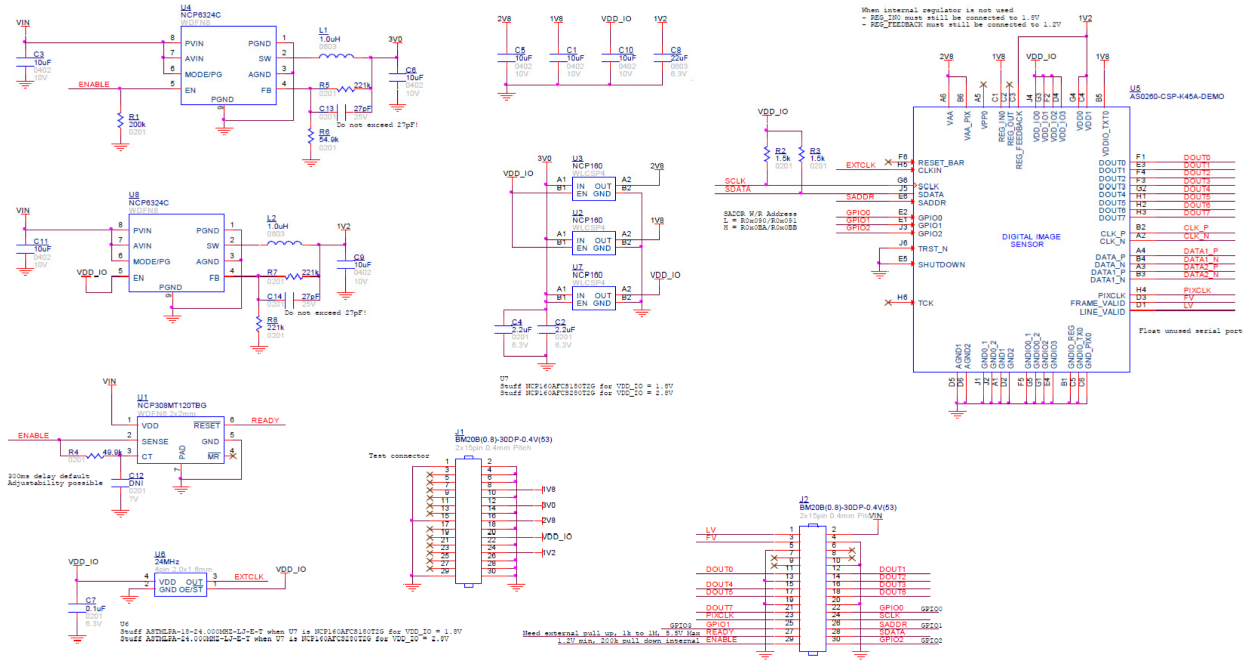


High level block diagram of AS0260 demo board with parallel interface, real size comparison.



Detailed power supply block diagram, 2x NCP6324 DC-DC and 2x NCP163 LDO used.

Schematic



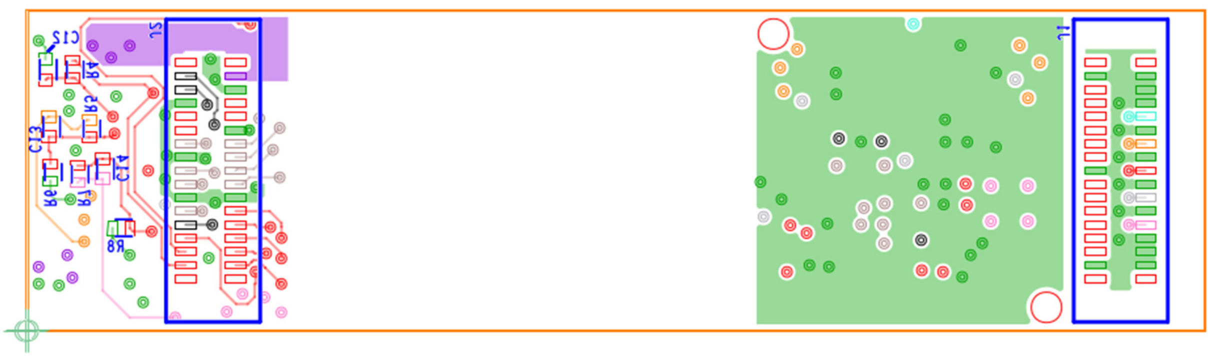
Note: NCP160 and NCP163 are pin to pin compatible.
NCP163 is an upgrade of NCP160 with improved PSRR and transient response.

PCB Details

(Shown with and without lens)

PCB Details (continued)

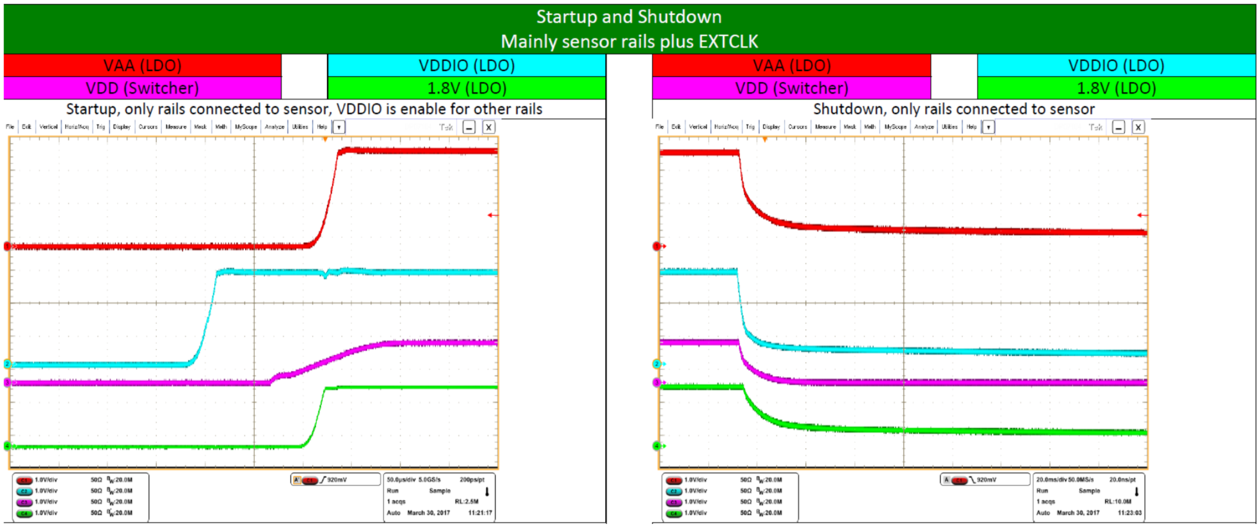
Top side of demo board with main components layout (not in scale).



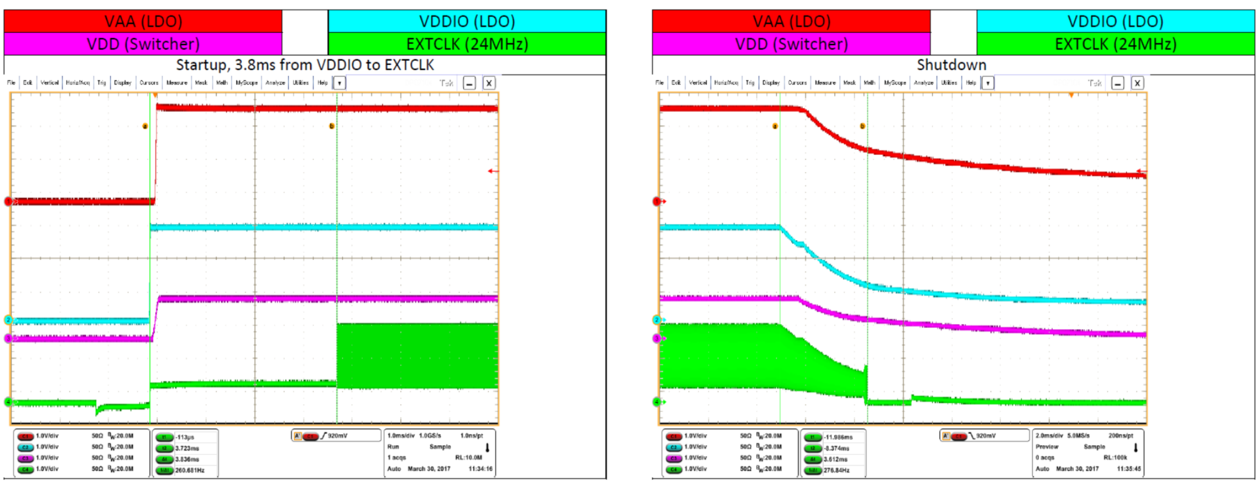
Bottom side of demo board with main components layout (not in scale).

This demo board was used to measure all following parameters related to AS0260 sensor.

Performance Information

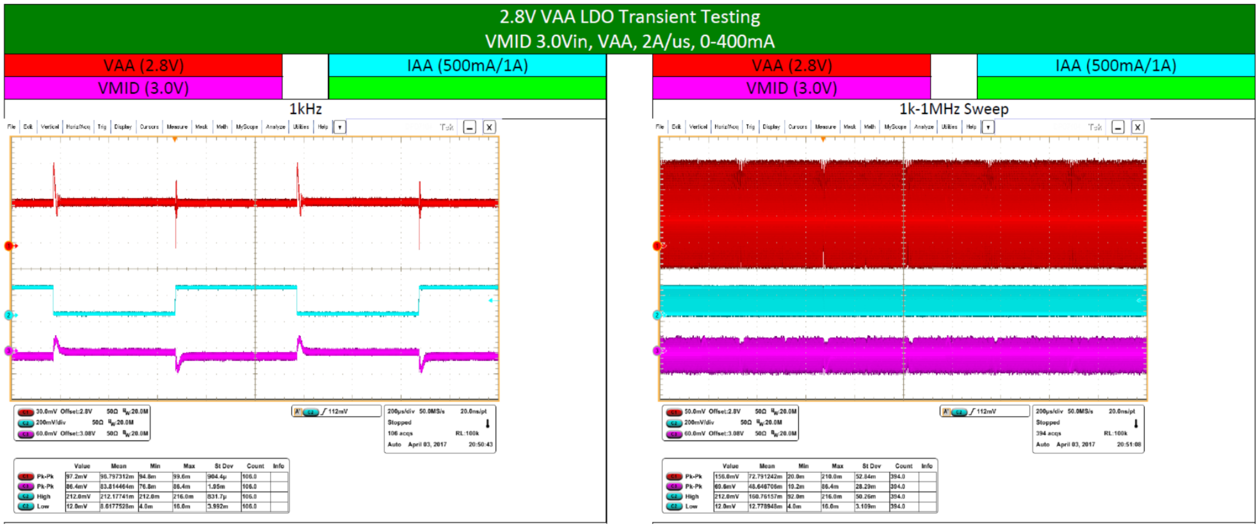


Detail of proper timing for all voltage rails, where red line shows VAA analog voltage 2.8V (the most important voltage for picture quality).

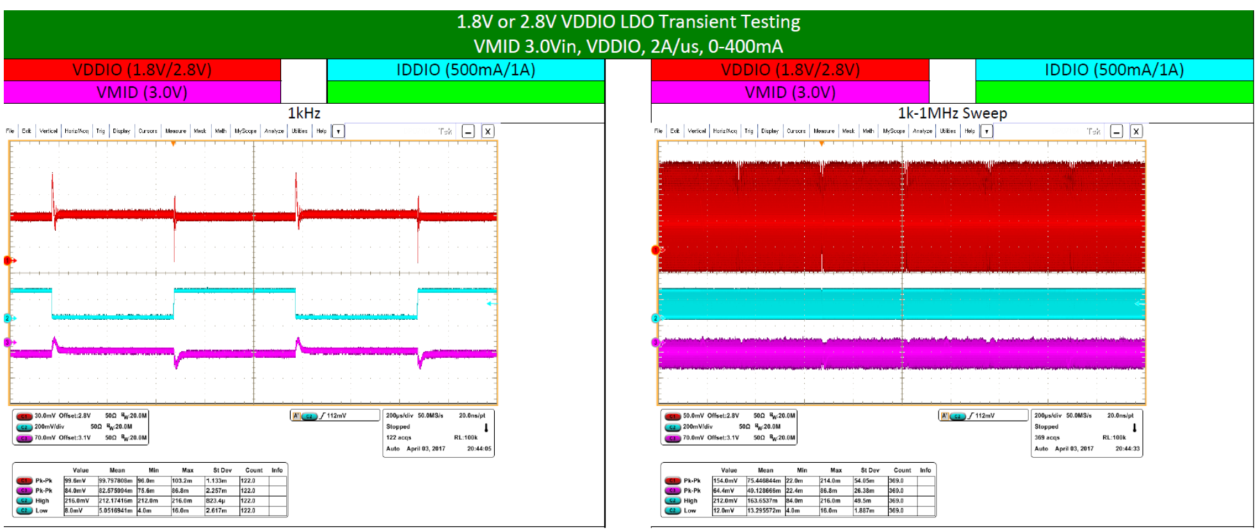


Detail of time delay between VDDIO digital voltage and AS0260 sensor clock signal for both startup and shutdown event.

Performance Information (continued)

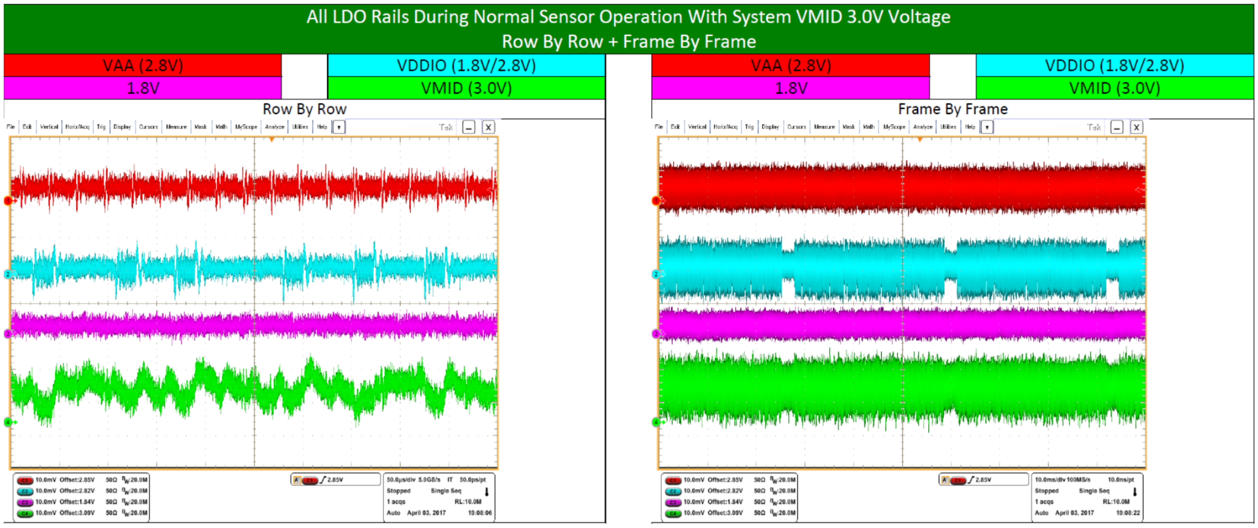


Transient testing waveform for VAA analog voltage 2.8V (NCP163 used), when supplied from 3.0V VMID voltage (see power block diagram).

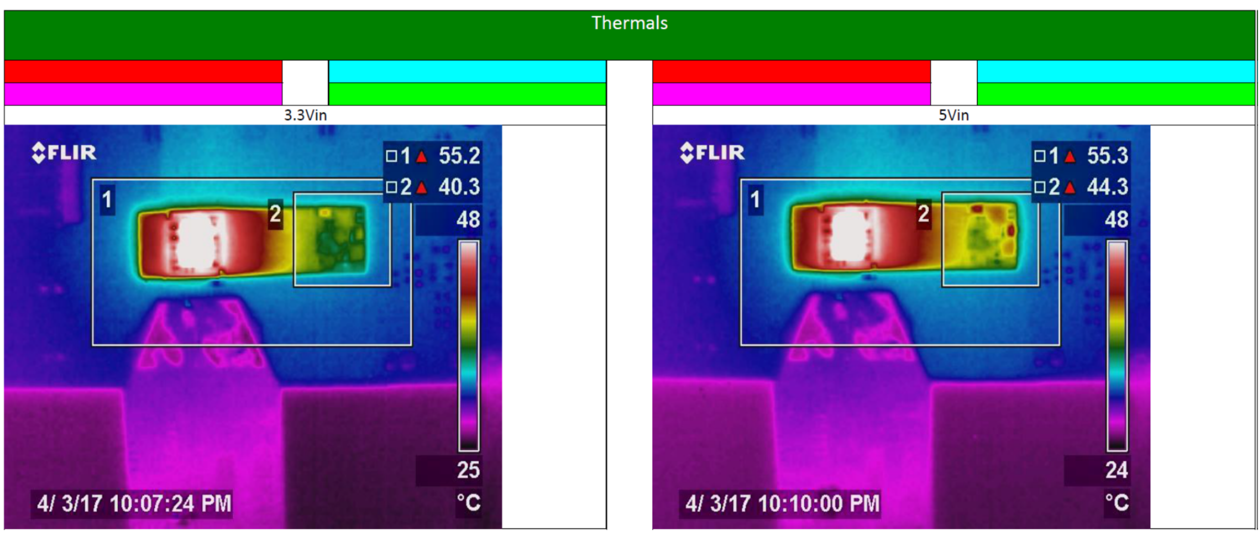


Transient testing waveform for VDDOI digital voltage 1.8V / 2.8V (NCP163 used), when supplied from 3.0V VMID voltage (see power block diagram).

Performance Information (continued)



Waveforms for all voltage rails during normal operation of AS0260 image sensor with VMID voltage set to 3.0V. Please note low VAA analog voltage ripple, which is crucial for image quality.



Thermal pictures of whole demo board for both standard input voltages 3.3V and 5.0V. Please note that input voltage 3.3V is better from efficiency and power dissipation point of view.

Conclusion

In this design note we presented how to create high-performance and very efficient power supply for AS0260 CMOS image sensor. Thanks to new NCP163 LDO regulator used for analog voltage rail it is possible to achieve superb image quality with minimum required area on PCB. This solution is not only cost effective, but also much better performing than any DC-DC regulator usually used on this position.