APPLICATION NOTE

LF Noise Measurement of D/A Converter

E4727B Advanced Low-Frequency Noise Analyzer with AD5601

Turnkey Solution for LF Noise Measurement

Keysight E4727B (Advanced Low-Frequency Noise Analyzer; A-LFNA) allows you to measure the LF (Low Frequency) noise of semiconductor devices very easily. The measurable device of E4727B is not only a semiconductor device (FET, BJT, etc.) but circuit (OpAMP. LDO, DAC, etc.) measurement is also available. The E4727B consists of hardware and software. The user can measure LF noise by just enter the expected measurement conditions and then the software will set all parameters of custom hardware optimally. The circuit measurement is very easy, and the customer only needs to prepare evaluation PCB and external instruments such as DC power supply and digital signal source. This Application Note shows an example of LF noise measurement of DAC (D/A Converter) with E4727B, and AD5601 is selected for DAC. The AD5601 is fabricated by Analog Devices, Inc. and is an 8-bit DAC operated from a single 2.7 V to 5.5 V supply.

Specification

Frequency:
30 mHz – 100 MHz

LNA Noise Floor:
-185 dBV²/Hz (Min)

LNA Band Width:
LNA1: 30 mHz – 1 MHz
LNA2: 1 Hz – 1 MHz
LNA3: 1 Hz – 100 MHz

ANALOG DEVICES

2.7 V to 5.5 V, <100 µA, 8-/10-/12-Bit *nano*DAC, SPI Interface in LFCSP and SC70

Data Sheet AD5601/AD5611/AD5621

FEATURES

- 6-lead SC70 and LFCSP packages
- Micropower operation: 100 µA maximum at 5 V
- Power-down typically to 0.2 µA at 3 V
- 2.7 V to 5.5 V power supply
- Guaranteed monotonic by design
- Power-on reset to 0 V with brownout detection
- 3 power-down functions
- Low power serial interface with Schmitt-triggered inputs
- On-chip output buffer amplifier, rail-to-rail operation
- SYNC interrupt facility
- Minimized zero-code error
- AD5601 buffered 8-bit DAC
  - B version: ±0.5 LSB INL
- AD5611 buffered 10-bit DAC
  - B version: ±0.5 LSB INL
  - A version: ±4 LSB INL
- AD5621 buffered 12-bit DAC
  - B version: ±1 LSB INL
  - A version: ±6 LSB INL

FUNCTIONAL BLOCK DIAGRAM

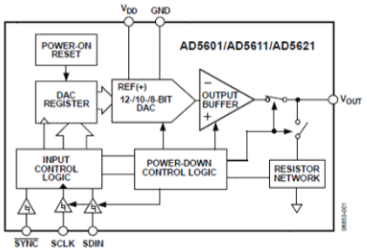


Figure 1.

Table 1. Related Devices

Part Number	Description
AD5641	2.7 V to 5.5 V, <100 µA, 14-bit *nano*DAC in

Figure 1. AD5601 datasheet

KEYSIGHT TECHNOLOGIES

Evaluation PCB

The customer needs to prepare an evaluation PCB like the following photo.

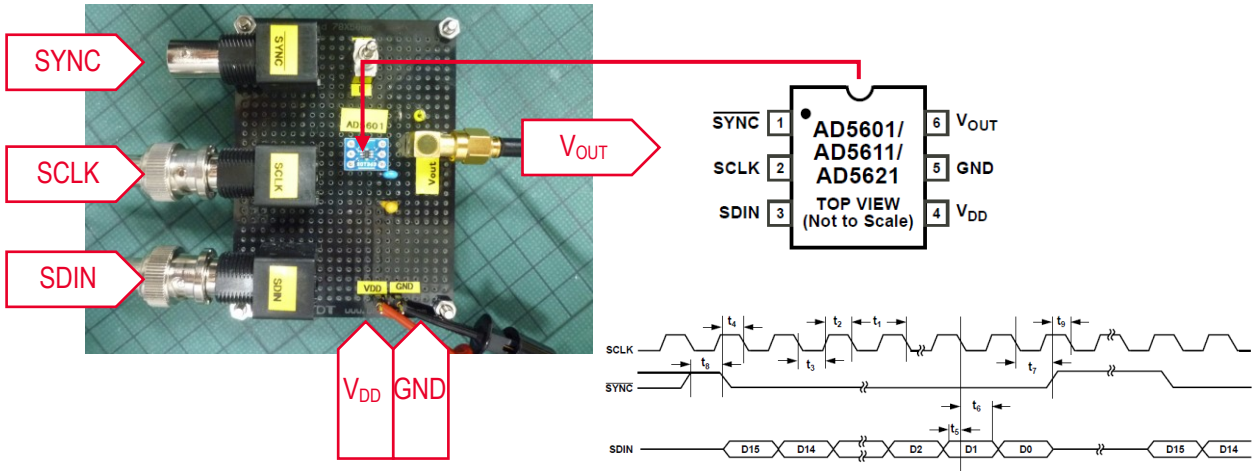


Figure 2. Photo of evaluation PCB to measure LF noise of AD5601

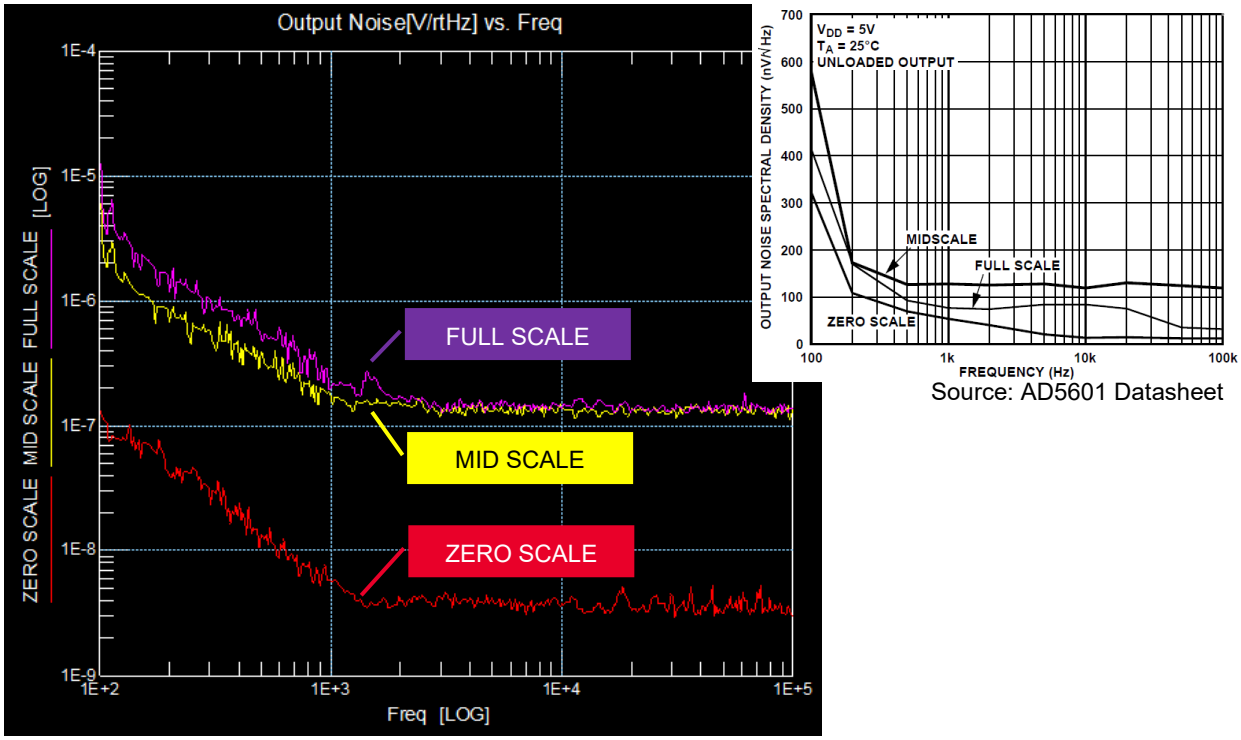
Connection with E4727B

The connection with E4727B is very easy and just connect V_{OUT} (output of AD5601) to Main Unit. The DC power supply and digital signal for the evaluation PCB are supplied from external instruments prepared by the customer.

Figure 3. Photo of connection between evaluation PCB and E4727B Main Unit

Results

The output LF noise of AD5601 measured by E4727B is shown in Figure 4. The measured conditions are V_{DD}=5.0V and unloaded output. The results are measured under ZERO SCALE, MID SCALE, and FULL SCALE to compare with the data in the datasheet. The results are very reasonable and the E4727B can get more accurate and continuous noise data in the measurement frequency band.



Source: AD5601 Datasheet

Figure 4. Output LF noise results of AD5601 and comparison with datasheet

Literature

E4727B/W7802B Advanced Low-Frequency Noise Analyzer/Measurement Bundle Software Data Sheet 3120-1435EN

Learn more at: www.keysight.com

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