White Paper No. 7

HUBERT power amplifier meets LV124

1 Introduction

For the electrical tests of electrical and electronic components in motor vehicles according to the standard LV124 or VW80000, depending on the EUT, fast power sources are required in different categories.
Due to their rather slow signal processing, usually the classic 1-quadrant power supplies are not always the optimal solution at this point.
The fast HUBERT 4-quadrant power amplifier are a versatile alternative for the simulation of a vehicle electrical system.

In the following sections, some tests will be presented from the LV124 exemplary. The focus is on the presentation of the transient characteristics of the HUBERT 4-quadrant power amplifier in the framework of the implementation of standardized tests.
The respective required number and definition of the test cycles, and the evaluation of the specimen are not part of the considerations

The needed waveforms were generated rudimentary with an arbitrary waveform generator by Agilent (Model 33509B) and the software Keysight BenchLink Builder Pro. For signal analysis an Agilent DSO X 3014a was used and the current was measured with the current probe Agilent N8721B.

A HUBERT 4-quadrant amplifier A1110-16-E provided the required power.

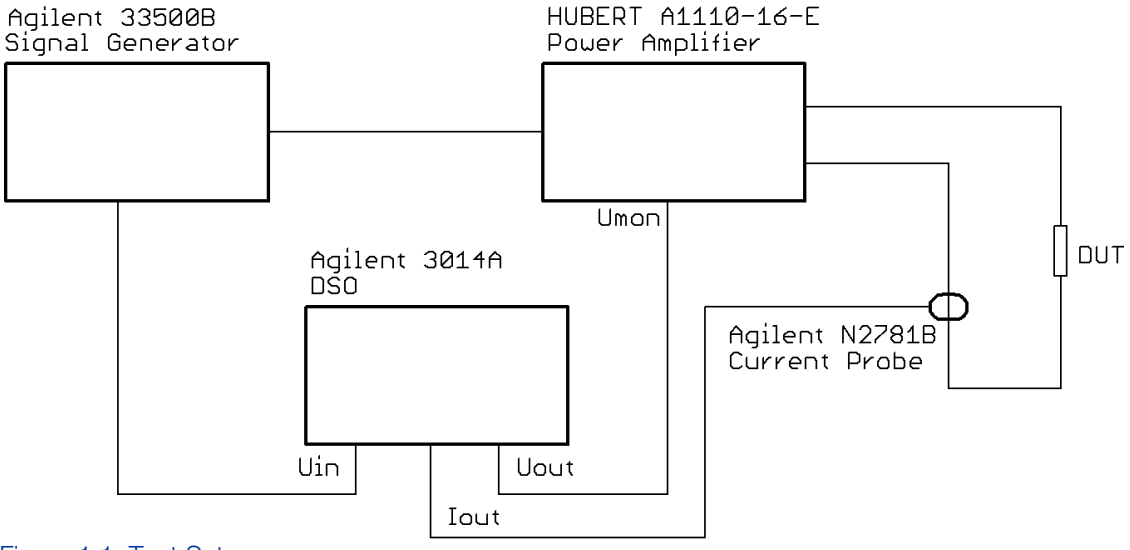

Figure 1.1: Test Setup

2 Tests

2.1 E-05 Load Dump

The dropping of a load leads, depending on the battery buffer capacity, to high-energy surge pulses in the electrical system.

The test signal is a voltage jump from the normal voltage 13.5 V to 27 V within 2 ms. After 300 ms, the voltage falls back to the normal voltage with a fall time of 30 ms. For the required output voltage, the operating voltage of the amplifier is switched to U_{mid}

EUT: resistive load, R = 2.15 Ohm
Amplifier Operating voltage: U_{mid}

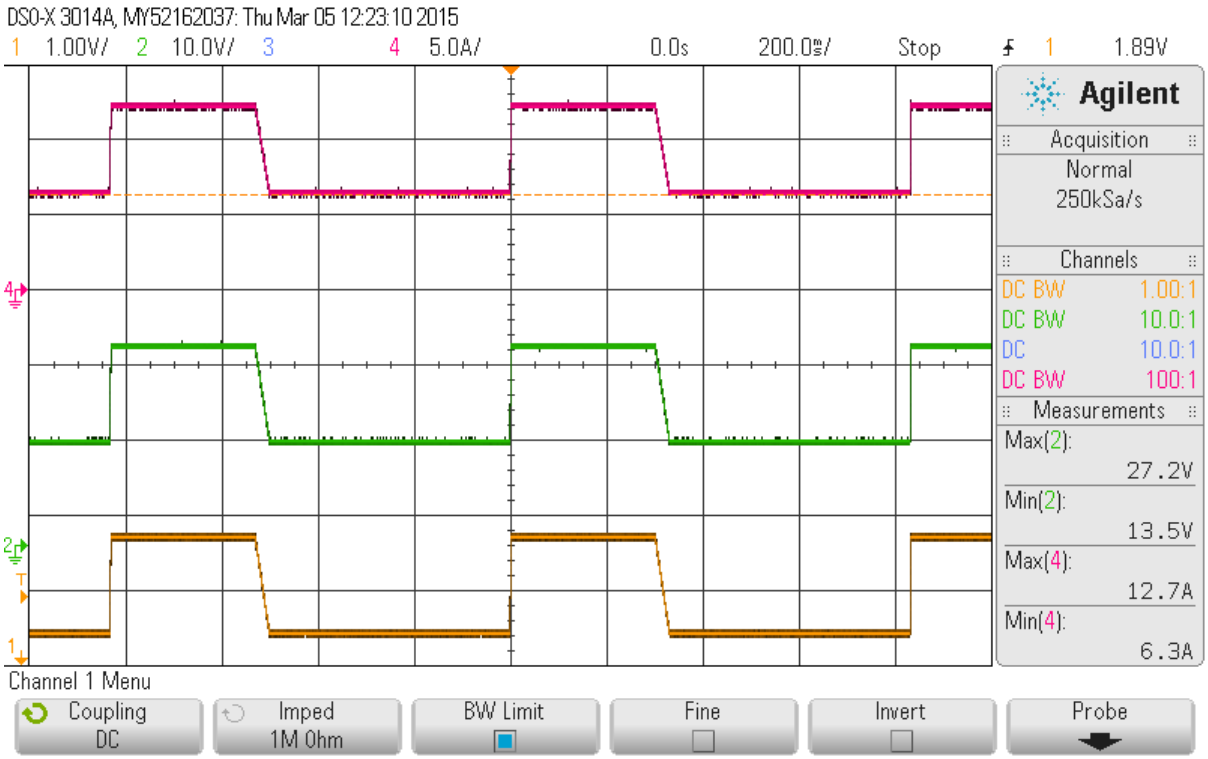

Figure 2.1.1: CH1=Uin; CH2=Uout;CH4=Iout

Figure 2.1.1 shows the output voltage and output current of the amplifier for three quick consecutive test cycles. The zoom in Figure 2.1.2 illustrates the quick response of the amplifier to the voltage jump.

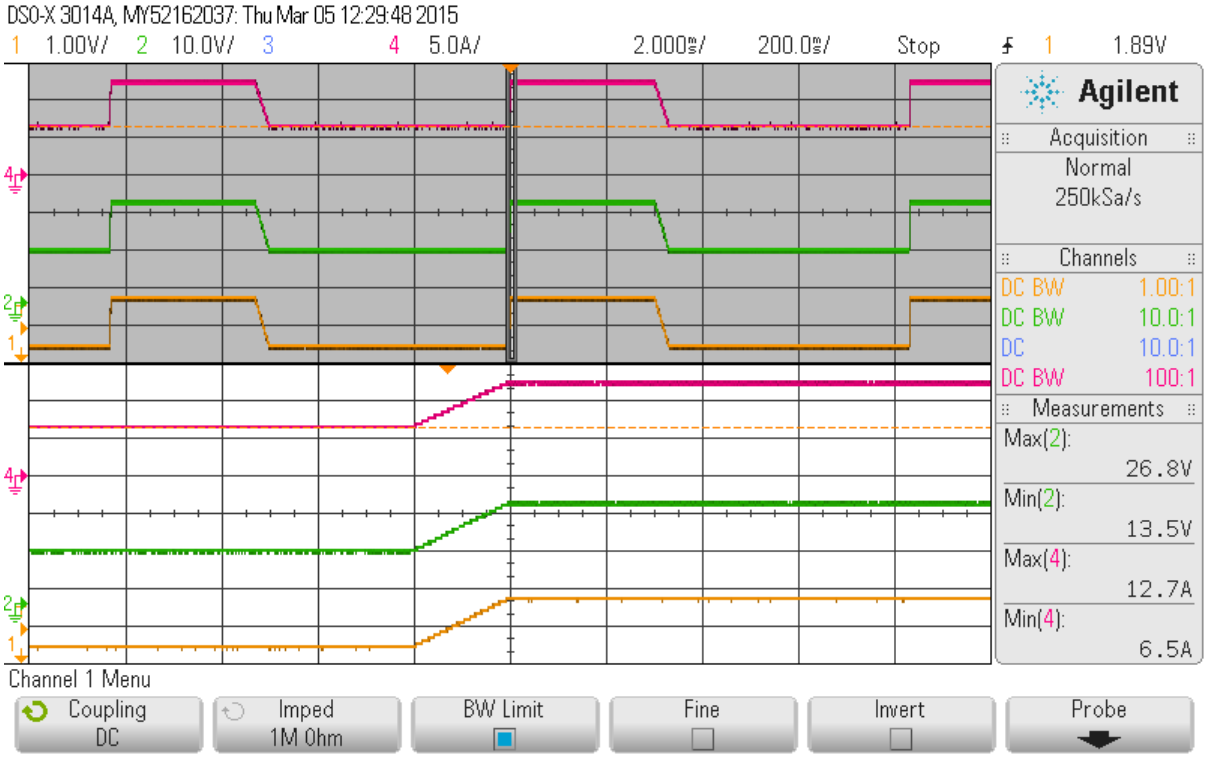

Figure 2.1.2: CH1=Uin; CH2=Uout;CH4=Iout

2.2 E-06 Superimposed AC voltage

AC voltages, which can be superimposed on the supply voltage are simulated with this test. For this purpose, a sliding sinusoidal signal of 15 Hz to 30 kHz with an amplitude of 6 V_{pp} (Test Case 3) is modulated on the on-board voltage. The required max. supply voltage is 16 V, and thus the operating voltage U_{low} can be selected for the amplifier.

EUT: resistive load, R = 0.55 Ohm
Amplifier Operating voltage: U_{low}

The following figures show the outputs of the amplifier at 25 Hz and 29 kHz at a load current of more than 26 A_p.

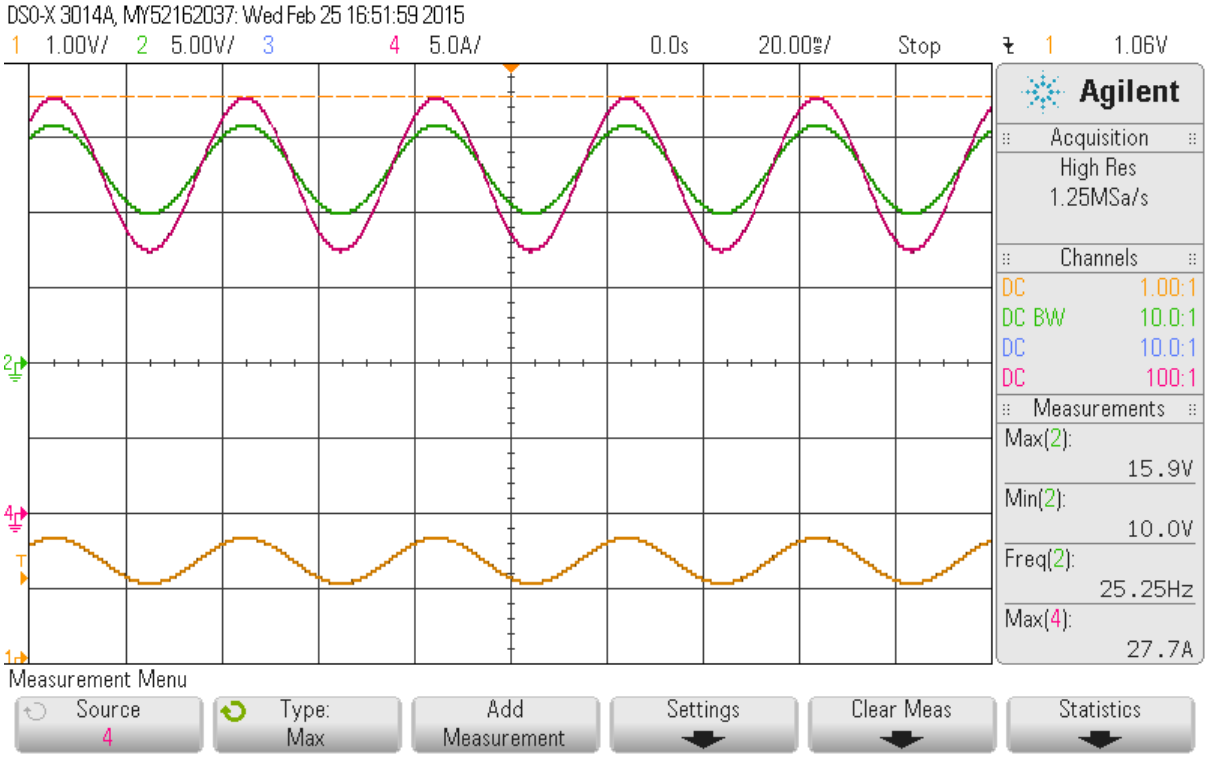

Figure 2.2.1: CH1=Uin; CH2=Uout;CH4=Iout; f=25 Hz

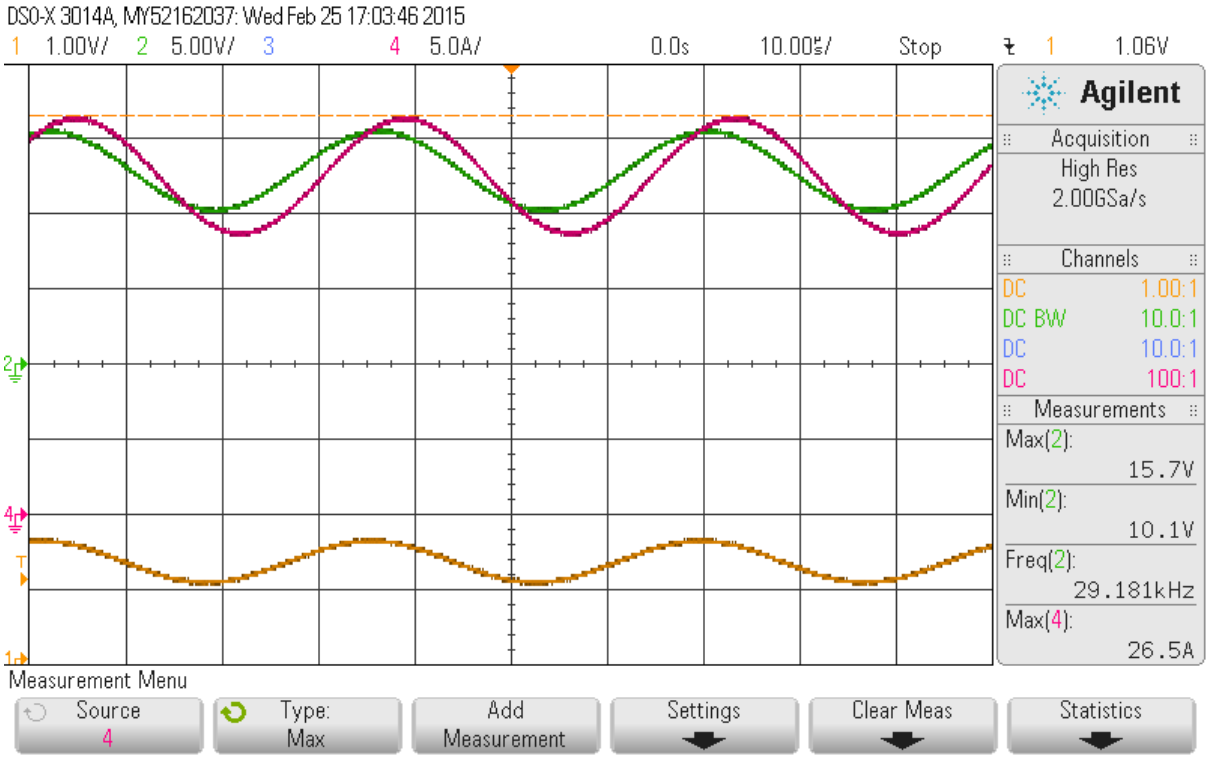

Figure 2.2.2: CH1=Uin; CH2=Uout;CH4=Iout, f=29 kHz

2.3 E-11 Start pulse

In this test the momentary voltage dips in the supply voltage during the starting phase of the engine are being simulated

Test Case 1 - cold start; Test pulse "sharp"
Load: R = 0.41 Ohm
Amplifier Operating voltage: U_{low}

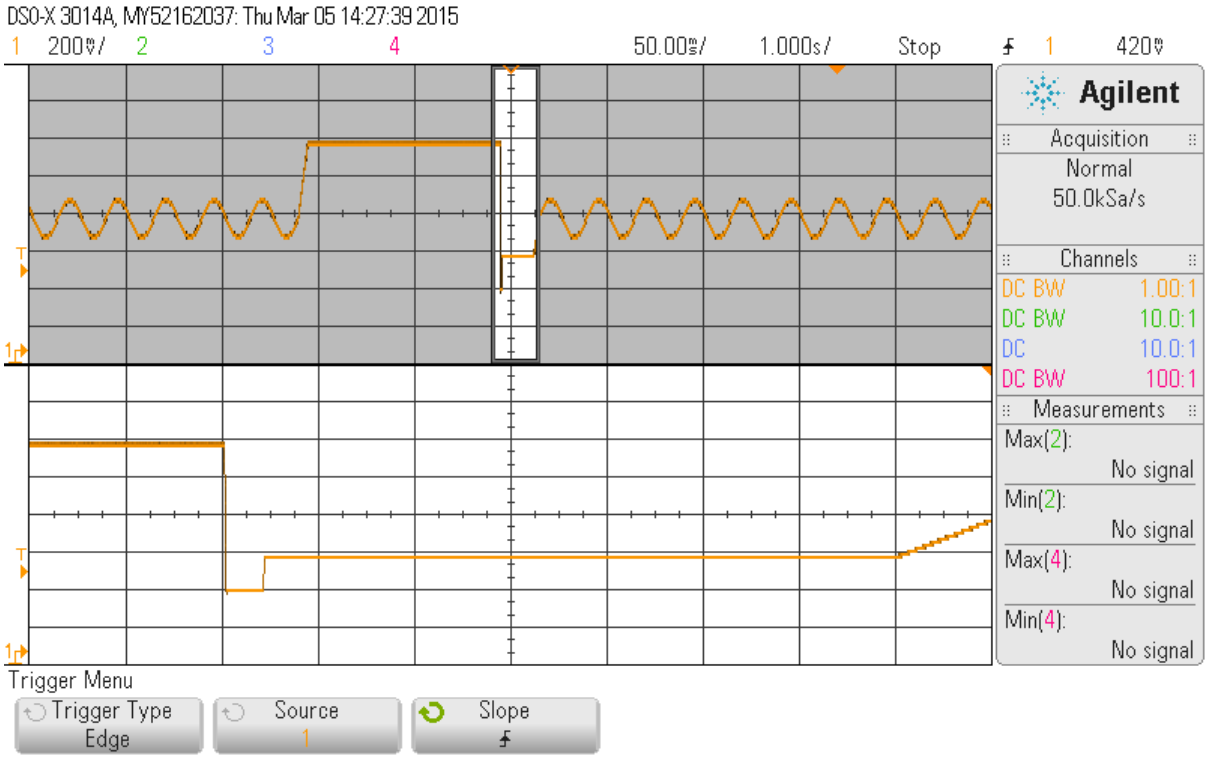

Figure 2.3.1: CH1=Uin

The operating voltage is normally 11 V and falls in the first part of the test to 3.2 V within1 ms. The first 400 ms of the generator signal U_{in} are shown in Figure 2.3.1.
Figure 2.3.2 shows the time course of a test cycle of 10.5 s. The output voltage U_{out} (green) follows chronologically the input voltage U_{in} (yellow). The load current I_{out} (red) is in this case 27 A during normal operation and follows the time profile of the output voltage: the zoom (Z1) in Figure 2.3.3 illustrates this.

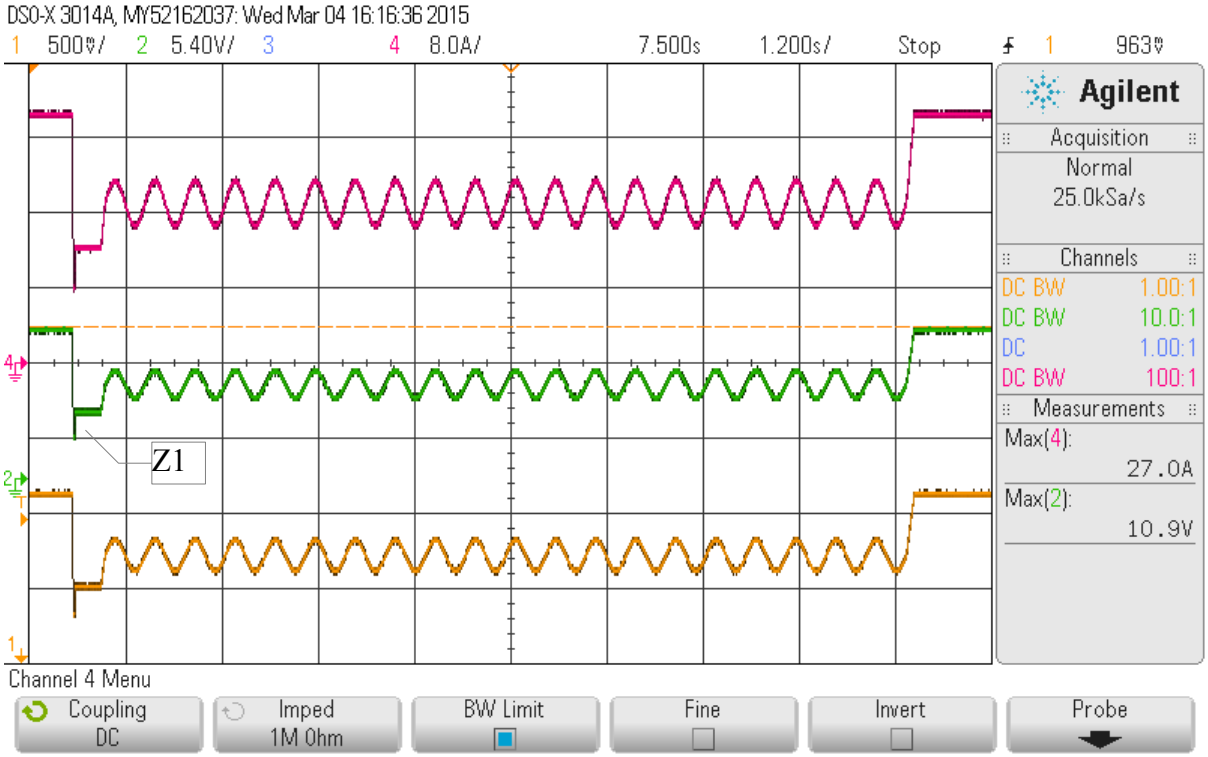

Figure 2.3.2: CH1=Uin; CH2=Uout;CH4=Iout

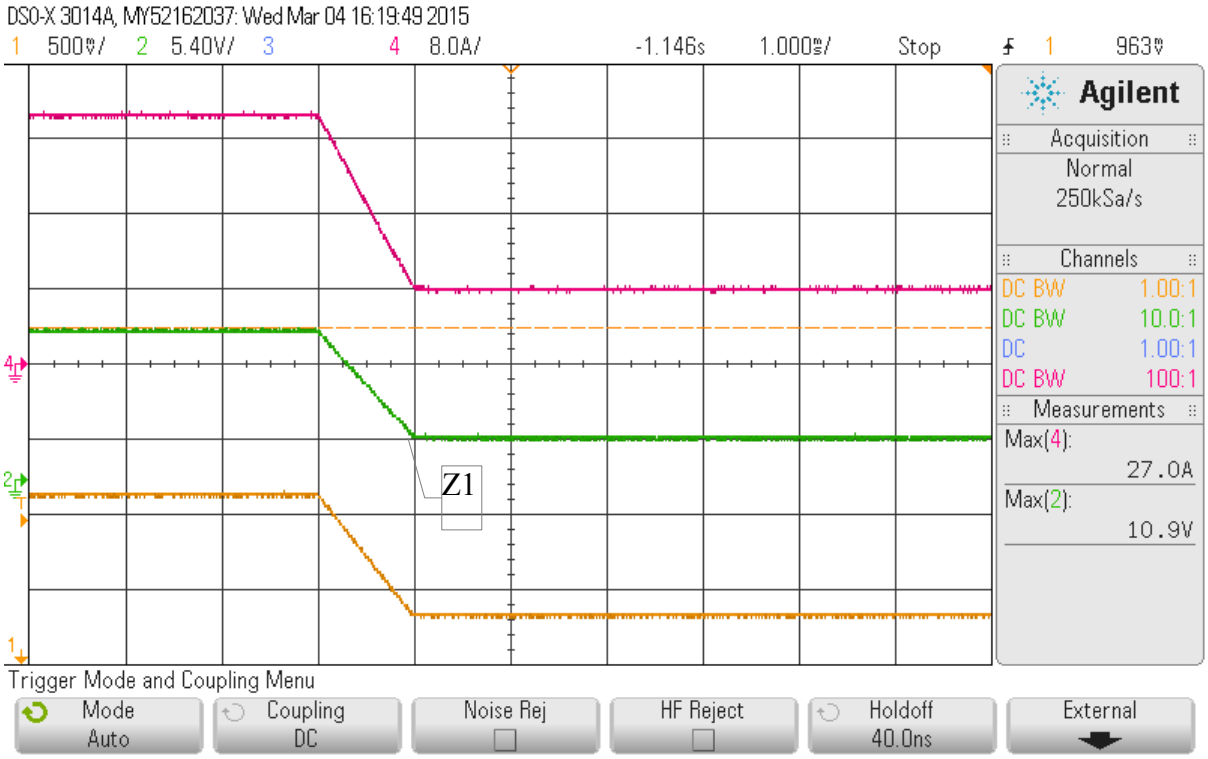

Figure 2.3.3: CH1=Uin; CH2=Uout;CH4=Iout

2.4 E-15 Reverse polarity

Jump-starting can lead to a reverse polarity connection of the external battery or power supply. The audit E-15 simulates this incident. For this, the supply voltage for the examinee is reversed from 10.8 V within to -4 V 10 ms.
After 8 ms, the voltage is then switched back again to +10.8 V with a rise time of 10 ms.
EUT: resistive load, R = 0.55 Ohm

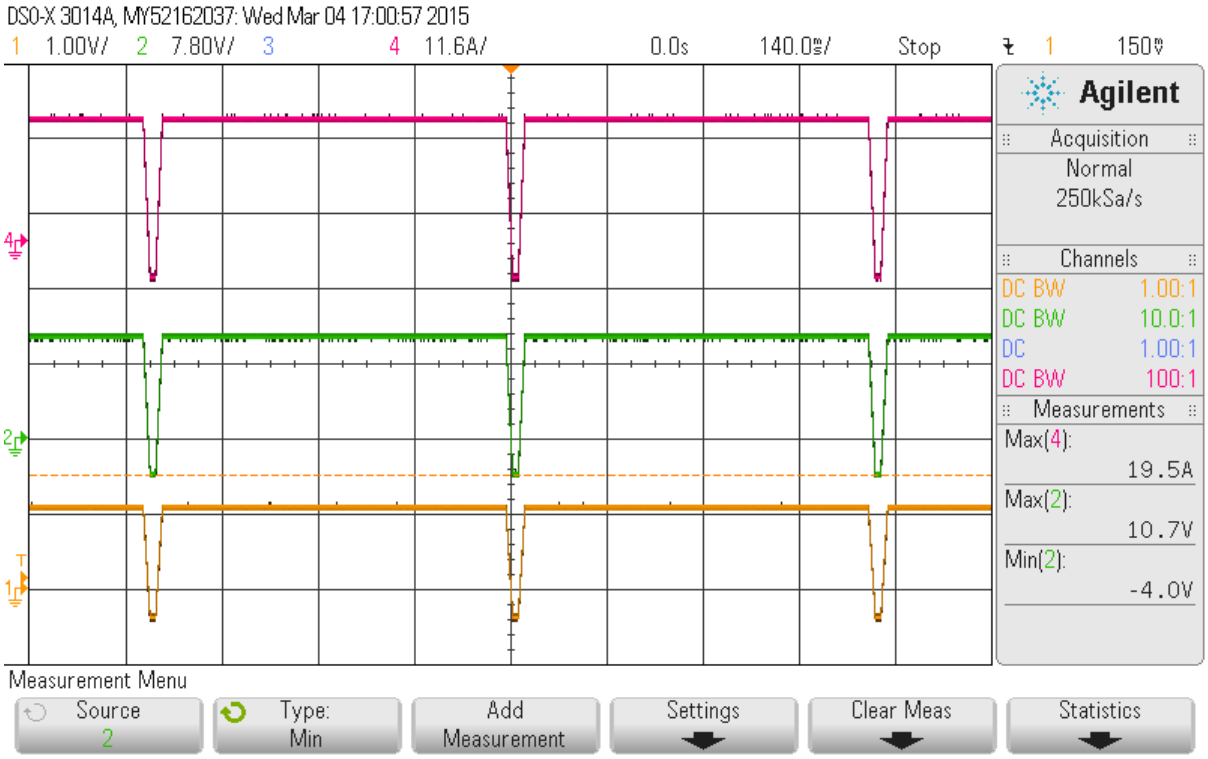

Figure 2.4.1: CH1=Uin; CH2=Uout;CH4=Iout

Figures 2.4.1 and 2.4.2 illustrate the signal quality of the amplifier. The required rise and fall times and a negative output voltage is provided by the amplifier without difficulties.

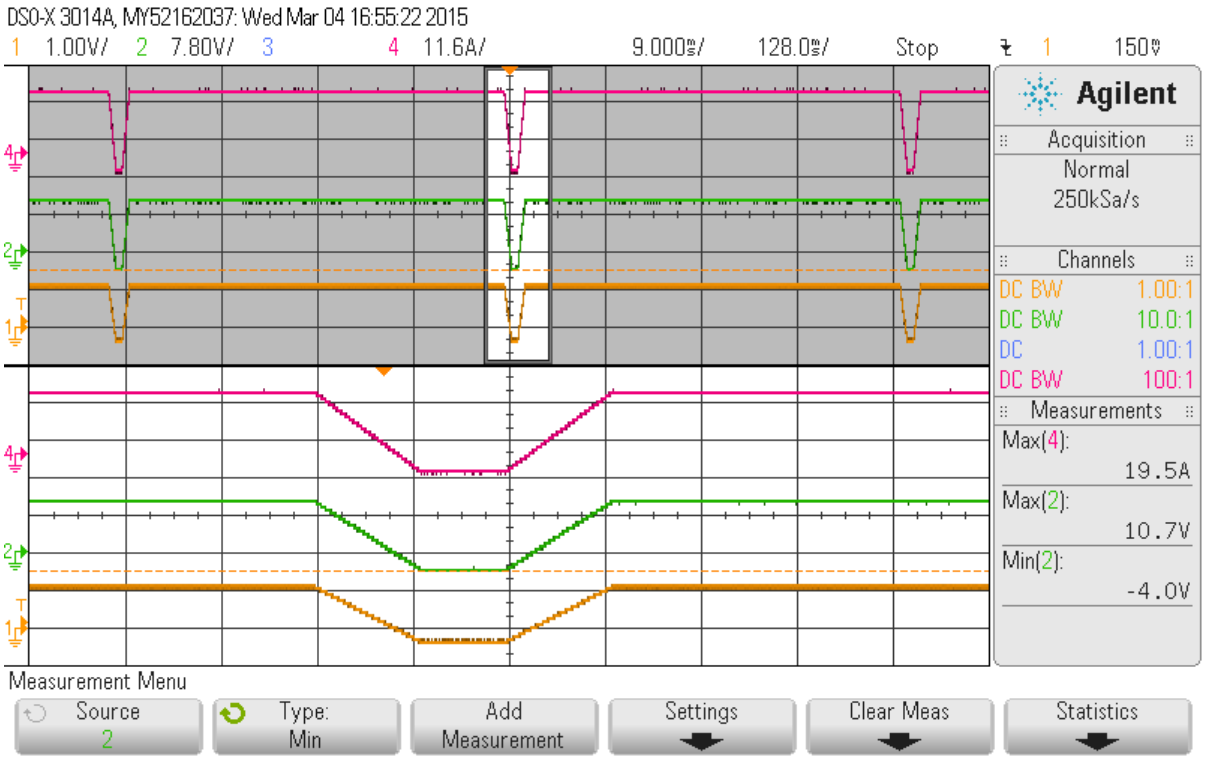

Figure 2.4.2: CH1=Uin; CH2=Uout;CH4=Iout

The time course of output voltage and output current with a Valeo wiper motor as a specimen is shown in Figure 2.4.3.

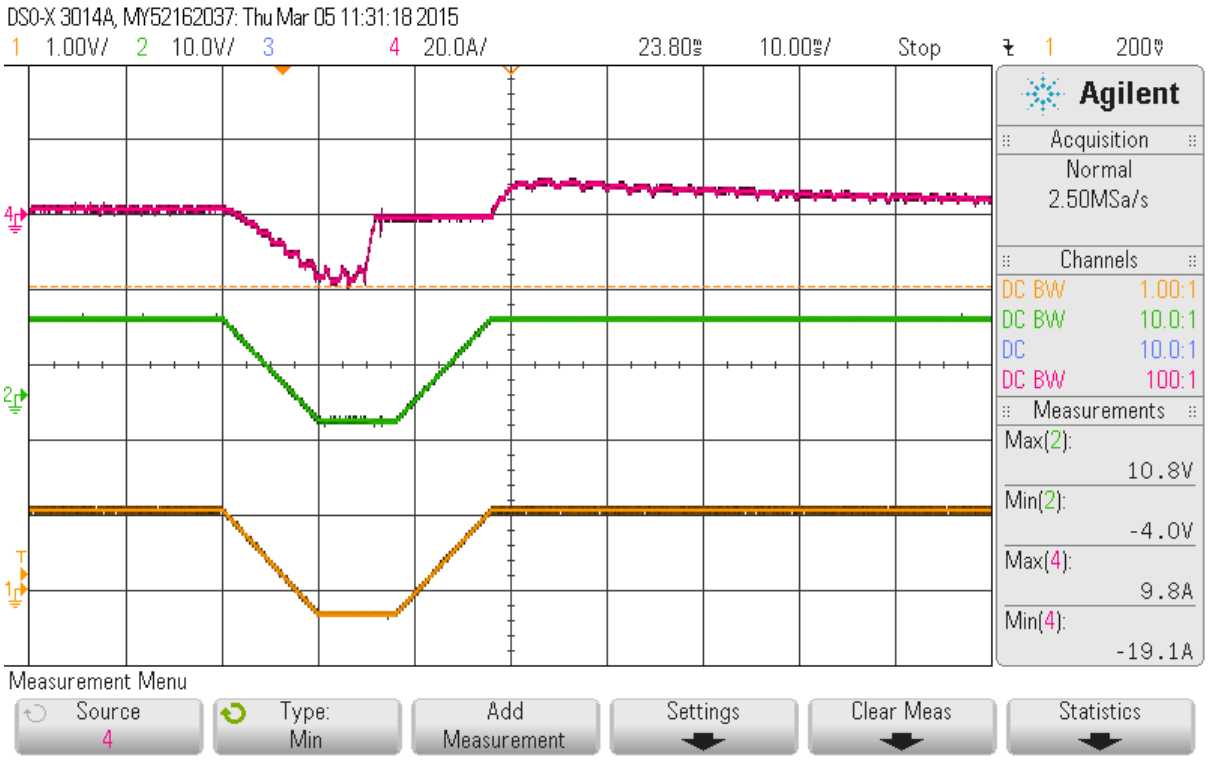

Abbildung 2.4.3: CH1=Uin; CH2=Uout;CH4=Iout

Striking here is the high negative load current (red) from the beginning of the voltage drop from 10.8 V to its minimum at -4 V.

3 Summary

For the electrical tests in accordance with LV124 or VW 80000 fast, bipolar power sources for the simulation of the electrical system are needed.

The above examples show:

The broadband HUBERT 4-quadrant line amplifiers are a suitable choice.
They deliver reliable the required test voltages at the required speed.

Which amp model or amplifier system (see also White Paper No.6: More Voltage and more current) is used, depends primarily on the required power and the required load current.
We would be happy to assits you designing your test site.

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