TR-AD9854-01
Testing Report

Customer Applications Center (CAC)

A simple way to generate pulses, 1Hz~120MHz, pulse width from few ns to hundreds ms, rise/fall time<2ns

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INTRODUCTION

The AD9854 digital synthesizer is a highly integrated device that uses advanced DDS technology, coupled with two internal high speed, high performance quadrature DACs to form a digitally programmable I and Q synthesizer function. The 12-bit Q DAC can be reconfigured to perform as a control or auxiliary DAC. The control DAC output can provide dc control levels to external circuitry, generate ac signals, or enable duty cycle control of the on-board comparator. The sin wave from the I DAC and the dc from the Q DAC are feed to the two input ports of the comparator, so the comparator is able to output duty cycle adjustable pulses. This testing report is based on this way to generate the pulses. Pulse signal is widely used in OTDR, radar signal source applications. The figure 1 shows how the pulses generate.

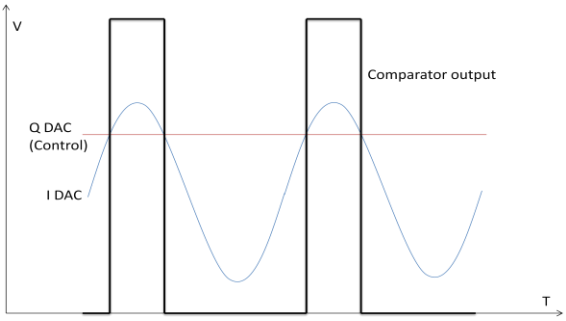

Figure 1. Principal of pulse generation

TESTING CONDITIONS

Indoor laboratory environment

TESTING SETUP

Install the evaluation software in the WinXP 32bit system. And power supply the AD9854 evaluation board with 3.3V. There is a 24MHz active oscillator for the reference source of the AD9854. The RF output or the comparator output is connected to the oscilloscope.

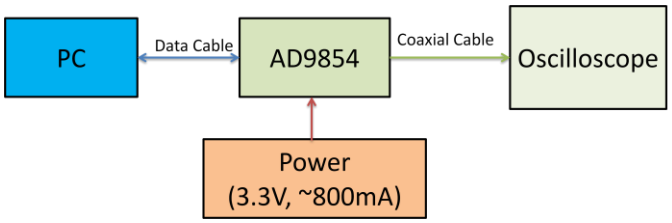

Figure 2. Testing System Framework

EQUIPMENTS

Equipment	Model	Manufacturer	Quantity
Oscilloscope	DS6062	Rigol	1
Power supply	E3631A	Agilent	1

Table 1. Testing Equipment

SCHEMATICS

The schematic of AD9854 can be downloaded from www.analog.com, which is partially shown as below.

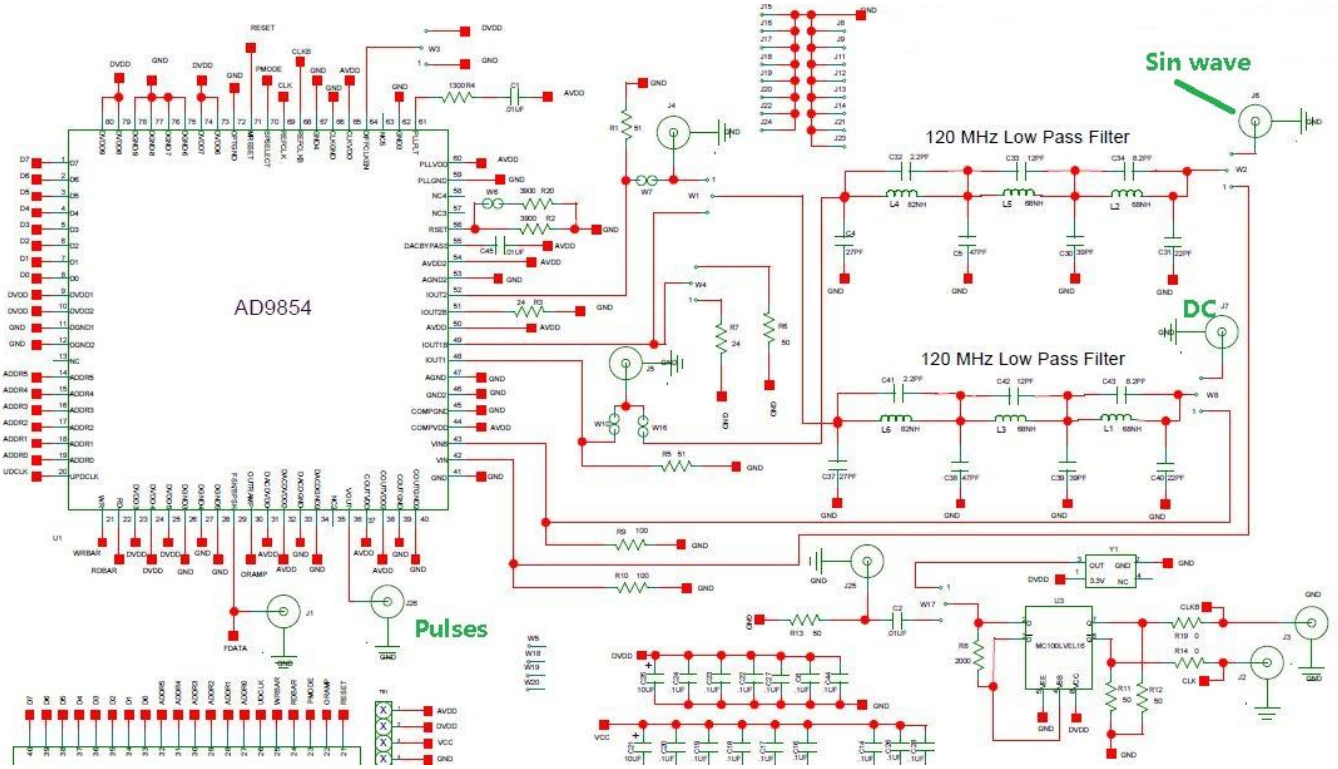

Figure 3. Testing Schematic

PROCEDURES

- Open the package of AD9854/PCBZ and read the instructions carefully.
- Setup the test system according to the framework.
- Power on the EVB board with 3,3V, the current is 600~900mA depend on the output frequency.
- Run the evaluation software.
- Configure the software and load registers.

RESULTS

We tested the output frequency from 1Hz to 100MHz, below is the results.

The output frequency of I DAC is 1Hz

Configure the output frequency of I DAC is 1Hz via the evaluation software. The output waveform from the I DAC is shown as the figure 4. The sin waveform swings between 156mV and 836mV. The minimum pulse width is about 92ms in this situation, as shown in the figure 5. The maximum duty cycle is 50%. The amplitude of the pulse is 3.3V

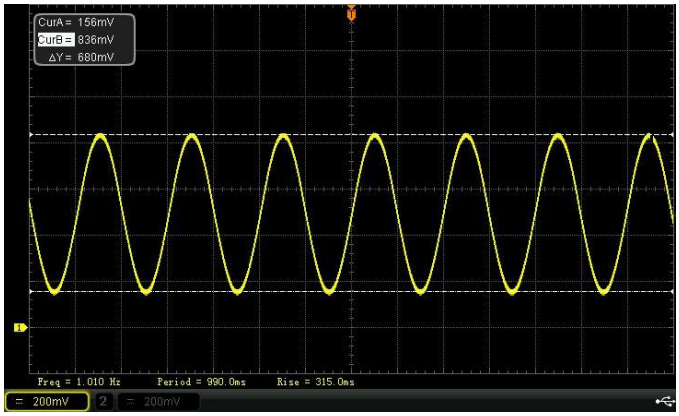

Figure 4. 1Hz sin wave from I DAC

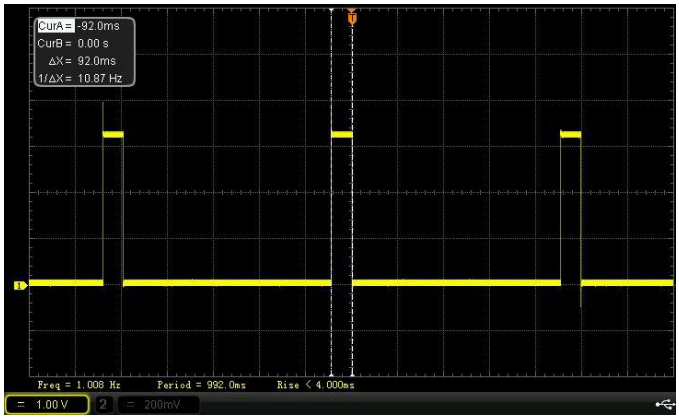

Figure 5. Pulses from the comparator

The output frequency of I DAC is 10Hz

Configure the output frequency of I DAC is 10Hz via the evaluation software. The output waveform from the I DAC is shown as the figure 6. The sin waveform swings between 148mV and 832mV. The minimum pulse width is about 10.4 ms, please refer to the figure 7. Also, the maximum pulse width is shown in figure 8.

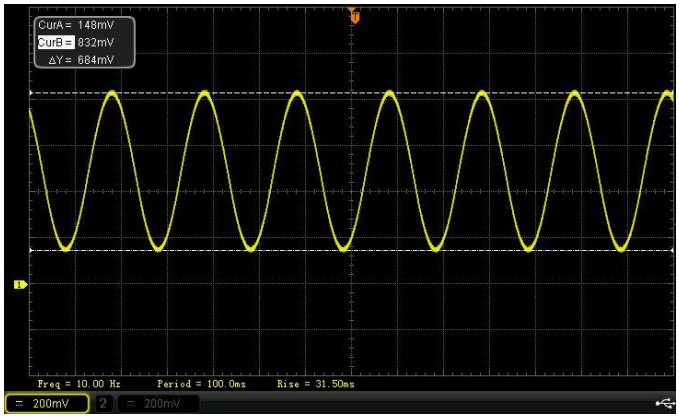

Figure 6. 10Hz sin wave from I DAC

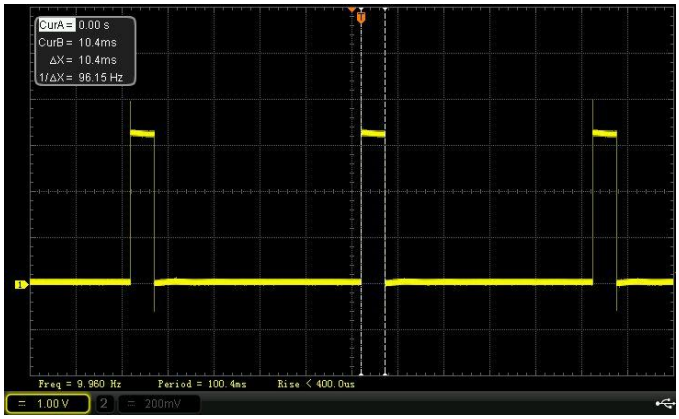

Figure 7. Minimum pulse width at 10Hz output frequency

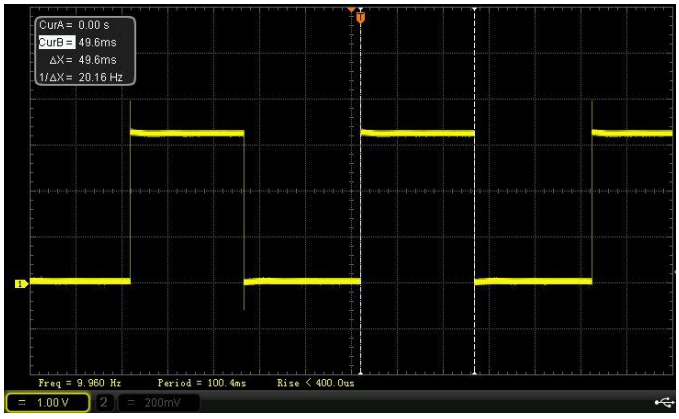

Figure 8. Maximum pulse width at 10Hz output frequency

The output frequency of I DAC is 100Hz

Configure the output frequency of I DAC is 100Hz via the evaluation software. The output waveform from the I DAC is shown as the figure 9. The sin waveform swings between 148mV and 832mV. The minimum pulse width is about 920us, please refer to the figure 10. Also, the maximum duty cycle is 50%.

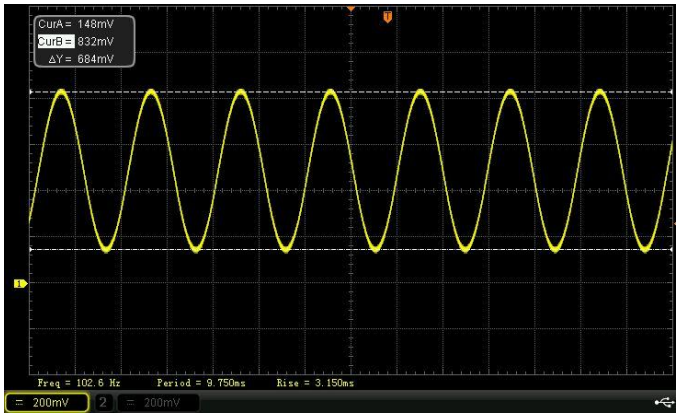

Figure 9. 100Hz sin wave from I DAC

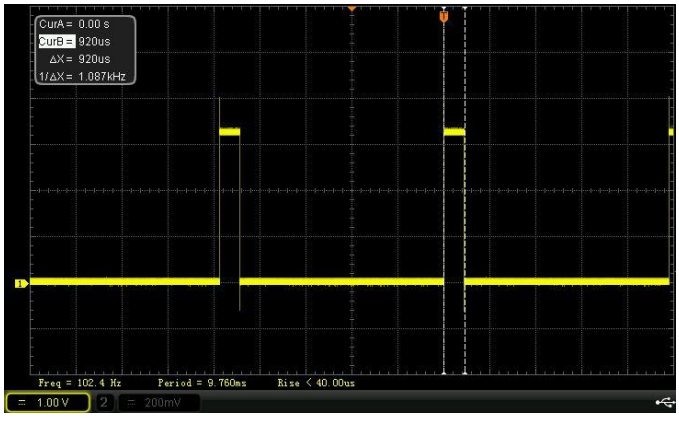

Figure 10. Minimum pulse width at 100Hz output frequency

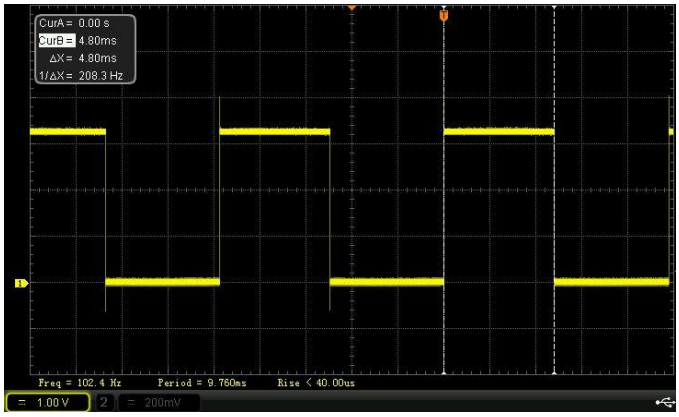

Figure 11. Maximum pulse width at 100Hz output frequency

The output frequency of I DAC is 1MHz

Configure the output frequency of I DAC is 1MHz via the evaluation software. The output waveform from the I DAC is shown as the figure 12. The sin waveform swings between 148mV and 832mV. The minimum pulse width is about 160ns, please refer to the figure 13. Also, the maximum duty cycle is 50%.

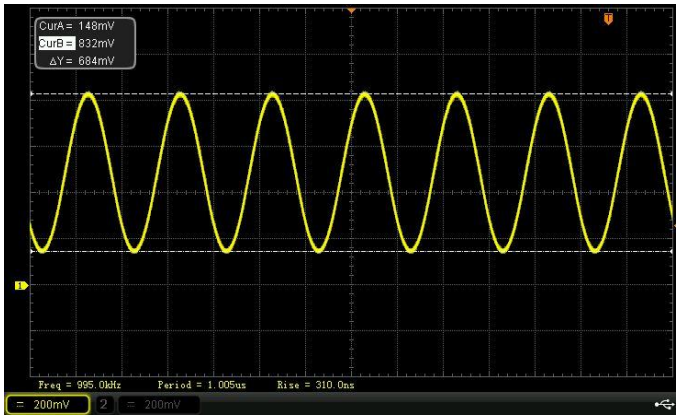

Figure 12. 1MHz sin wave from I DAC

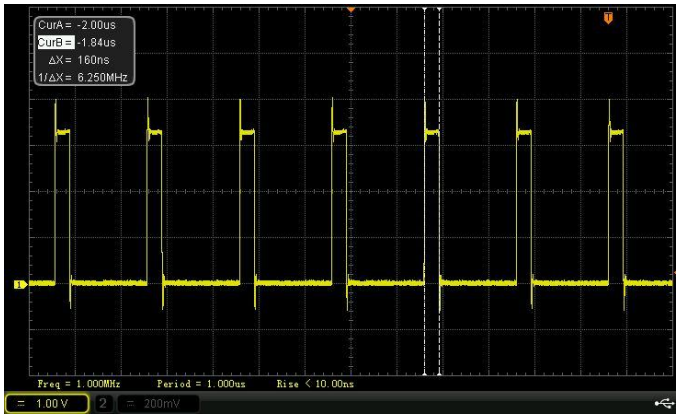

Figure 13. Minimum pulse width at 1MHz output frequency

The output frequency of I DAC is 10MHz

Configure the output frequency of I DAC is 10MHz via the evaluation software. The output waveform from the I DAC is shown as the figure 14. The sin waveform swings between 176mV and 804mV. Figure 15 presents the 10ns width waveform. Zoom in the pulse in figure 16.

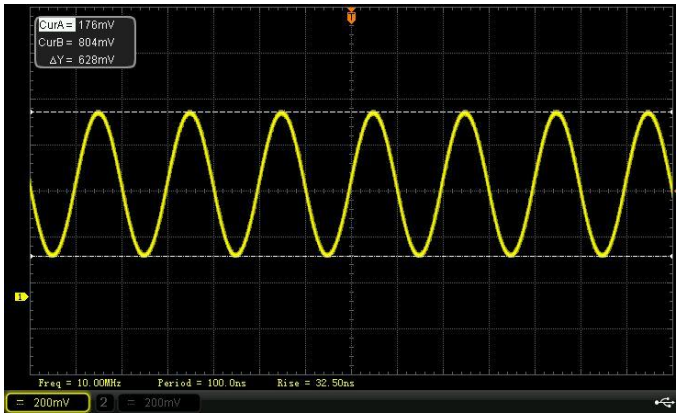

Figure 14. 10MHz sin wave from I DAC

Figure 15. 10ns pulse width at 10MHz output frequency

Figure 16. 10ns pulse width

The output frequency of I DAC is 100MHz

Configure the output frequency of I DAC is 100MHz via the evaluation software. The output waveform from the I DAC is shown as the figure 17. The sin waveform swings between 200mV and 776mV. Figure 18 presents the 4.84ns pulse width waveform, the rise time is about 1.3ns as shown in figure 19. Figure 20 shows the 2.8ns pulse width.

Figure 17. 100MHz sin wave from I DAC

Figure 18. 4.84ns pulse width at 100MHz

Figure 19. 1.28ns rise time at 100MHz

Figure 20. 2.8ns pulse width at 100MHz

Summarize the test results in the Table 2.

Frequency	Sin Wave Swing(mV)	DC Bias(mV)	Min Pulse Width
1Hz	156~ 836	496	92ms
10Hz	148~832	490	10.4ms
100Hz	148~832	490	920us
1MHz	148~832	490	160ns
10MHz	176~804	490	~10ns
100MHz	200~776	488	~3ns

Table 2. Min Pulse Width VS Frequency

ANALYSIS

The impedance of the oscilloscope input port is Hi-z.

CONCLUSION

There are a lot of instruments in the markets which features pulses generation, but they are cost. This report has provided the test results of generation pulses in a simple way.

REFERENCE

1. MT-085 Tutorial, Fundamentals of Direct Digital Synthesis (DDS), Analog Devices.

2. MT-086 Tutorial, Fundamentals of Phase Locked Loops (PLL), Analog Devices.

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