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Fine Delay Adjust Issue with GUNTX-200

Contents

Introduction

The Electron Gun Driver set utilises a special encoding scheme where the transmitter signal consists of a 500 MHz clock signal where missing transitions cause the receiver output to change state. Because of the encoding a step resolution for rising and falling edges of the receiver output is 2 ns. For fine tuning a delay line Micrel SY100EP196 with step resolution of about 10 ps is included in the signal path. This fine delay chip delays the whole encoded signal.

The delay of the delay line is set by a ten bit register. It was noticed that sudden change of the delay line setting can cause false triggers and the output signal of the receiver to stay high until the falling edge of the next trigger. The work-around is to adjust the delay line only step-by-step without jumping steps.

In this document another solution is introduced that forces the receiver output low during a delay adjust. The only issue with this solution is that if the fine delay is adjusted at the same time the receiver output pulse is active the output pulse will be cut short. We suggest to only adjust the fine delay when the triggers are disabled.

Encoding Details

1 ns Step Change without Firmware Update

Figure 1 below shows the GUNTX output signal when a step change of 1 ns is applied to the Micrel SY100EP196 delay line. The pulse in the middle of the scope screen is stretched by 1 ns and this is decoded as a ‘pulse high’ by the GUN-RC. After receiving this kind of signal the output of the GUN-RC stays high until the next ‘pulse low’ is detected.

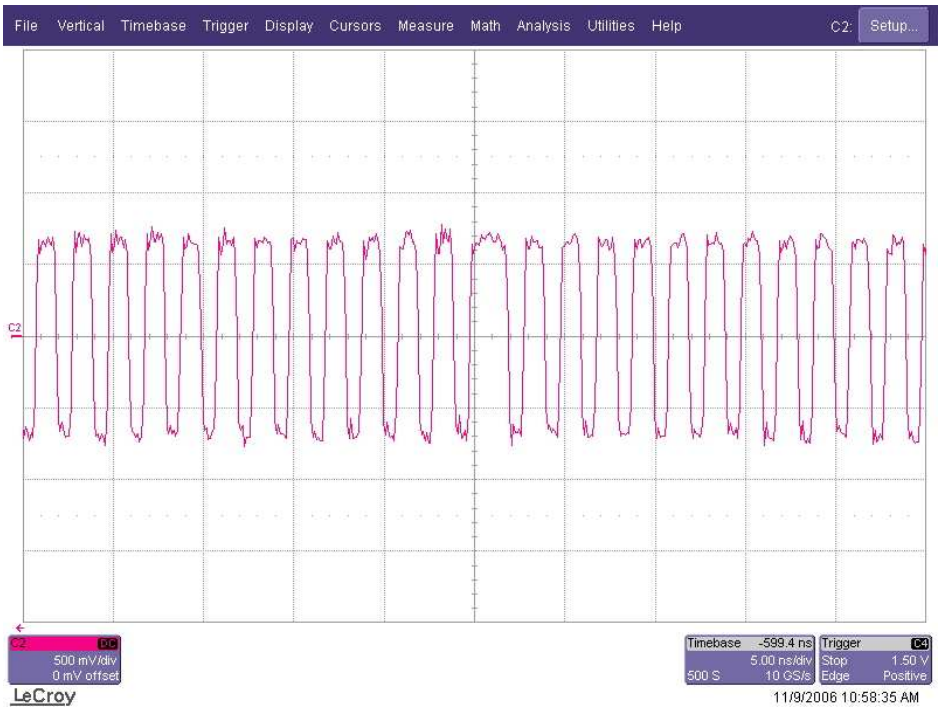

Figure 1: 1 ns Delay Step Change

Firmware Update (version guntx.091106.bin)

A firmware update was needed to solve this issue. The solution is to drive the output signal low when the delay line setting is changed. The Micrel SY100EP196 delay line chips have a parallel interface and a latch enable signal. The input into the delay line is driven low > 10ns before the latch enable to make sure all delay stages are low inside the delay line when delay line setting are changed. The timing of the latch enable signal and delay line input is shown in Figure 2and Figure 3 for channel 1 and channel 2 respectively.

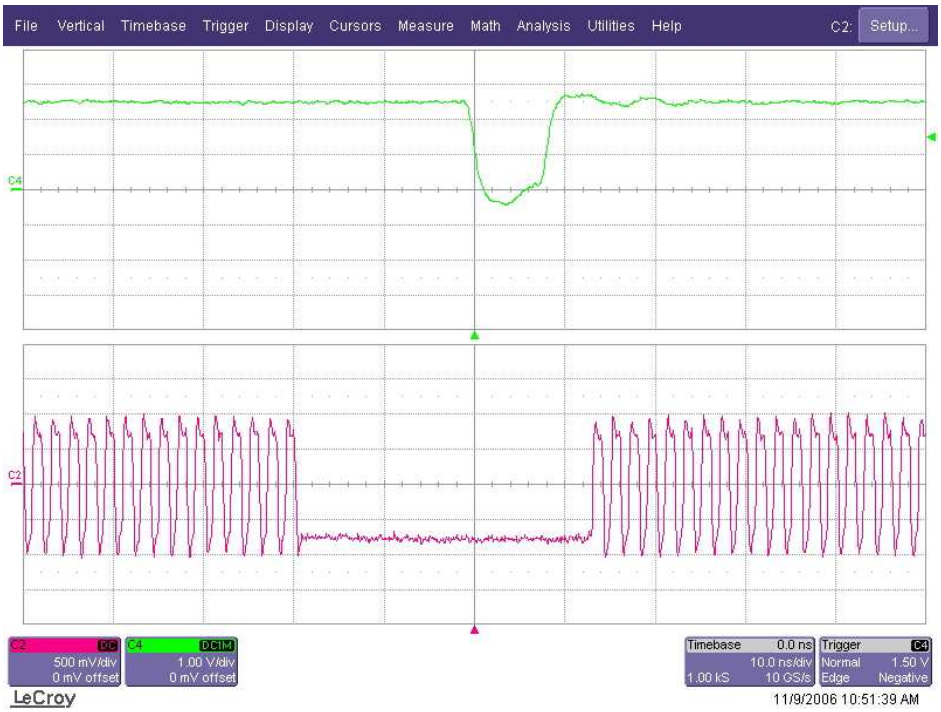

Figure 2: Delay Line Input and Latch Enable for CH1

Figure 3: Delay Line Input and Latch Enable for CH2

Delay Line Output Waveforms for CH1

Figure 4 shows the delay line output signal at the time the delay line setting is changed from 0 to 0x3FF. If we compare this figure with Figure 2 we see that the low gap starts slightly over 2 ns after the delay line input. This is the minimum propagation delay of the delay line. The gap in Figure 4 now is longer than in Figure 2 because the delay line setting has been changed from 0 to 0x3FF the maximum. The difference is approximately 9.8 ns which represents the total adjustable range of the delay line. From the figures one can see that all delay line elements have been flushed and are all zero prior to changing the delay setting. The output remain zero for quite some time after the change, too.

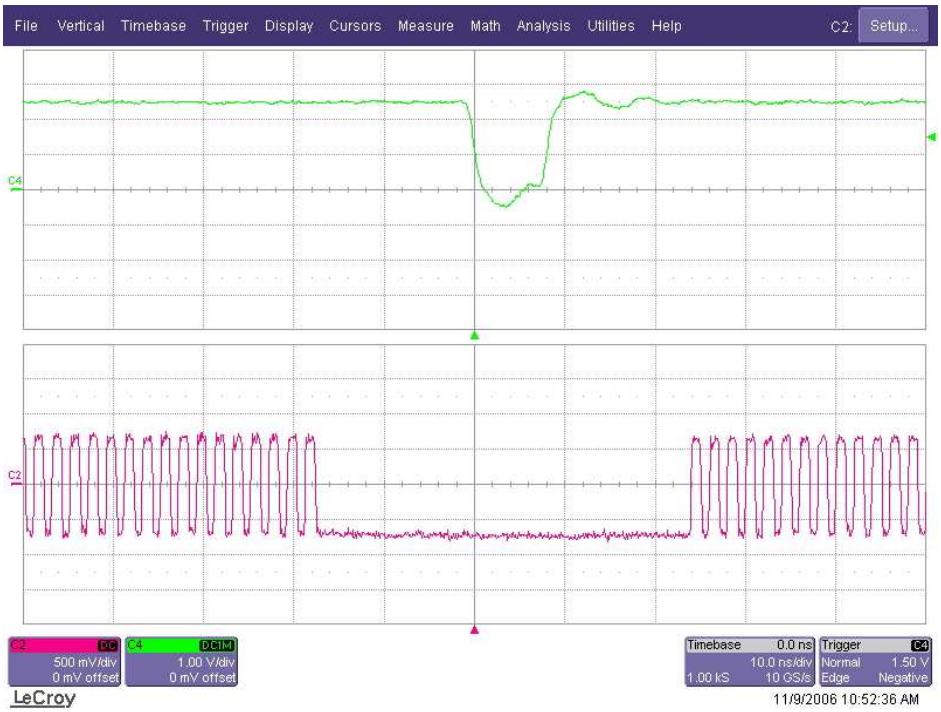

Figure 4: Delay Line Output on CH1, Delay Change 0 -> 0x3FF

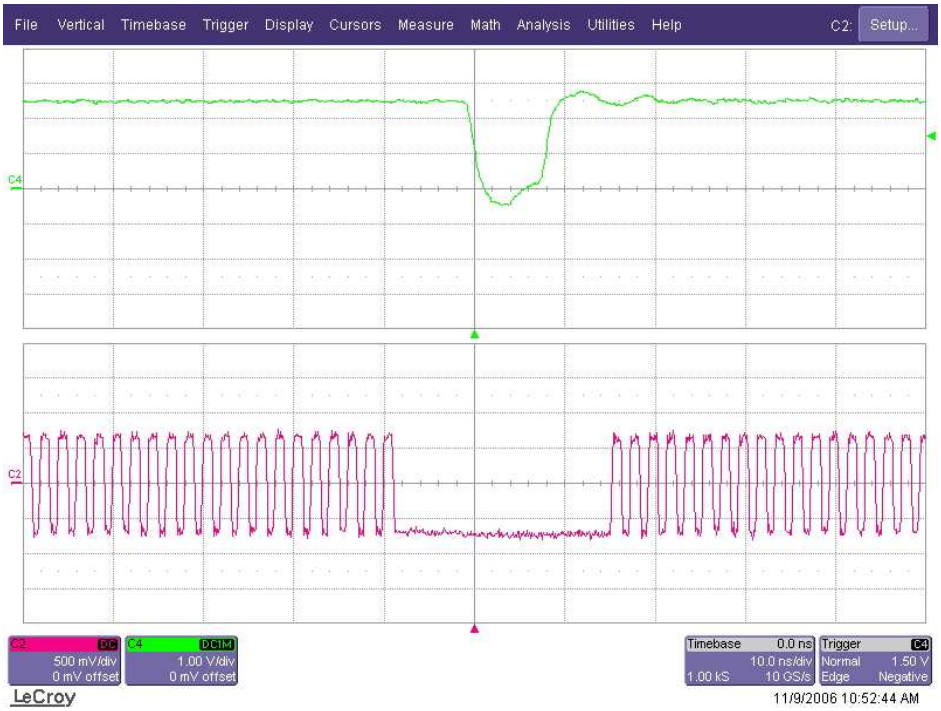

Figure 5: Delay Line Output on CH1, Delay Change 0x3FF -> 0

Delay Line Output Waveforms for CH2

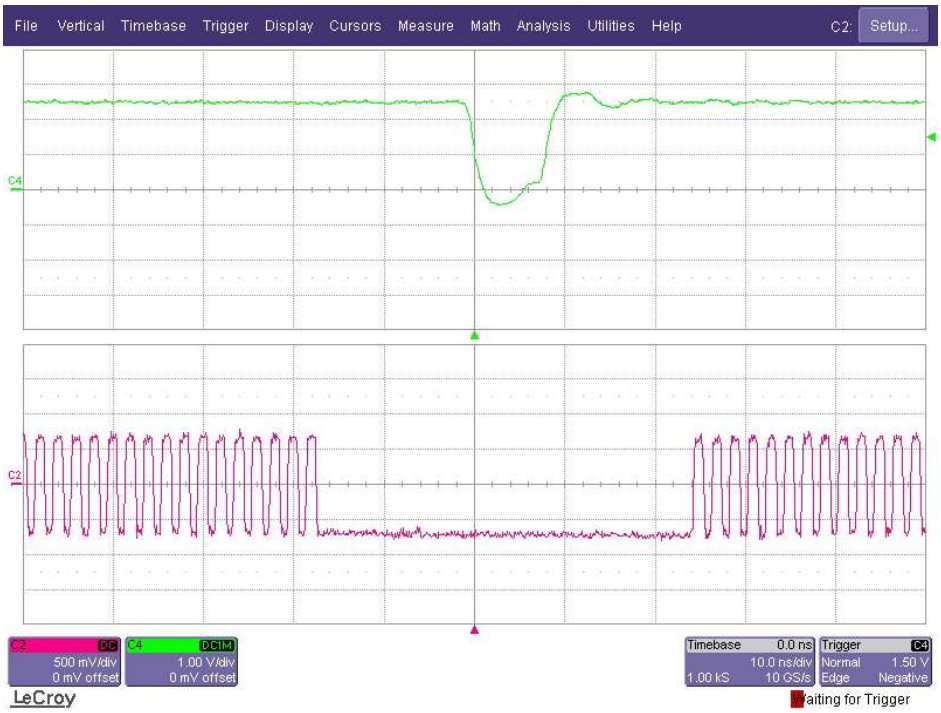

Figure 6: Delay Line Output on CH2, Delay Change 0 -> 0x3FF

Figure 7: Delay Line Output on CH2, Delay Change 0x3FF -> 0