BPG Drive Amplifier Test Results

Introduciton:

This document consists of a series of oscilloscope measurements capturing the signals at various places in the drive amplifier board. It is a long series of measurements done as I iterated towards a solution, trying different things. So its almost a narrative of the process, describing experiements that were tried and end with the final (well…mostly final) set of measurements for production unit.

All measurements were performed on the first article prototype board.

Note that the oscilloscope date in the screenshots is correct, but the time is not right.

New Drive Amplifier: Tp2 (preamp output / U1 = THS4271) / Driving with AWG with Booster pattern

Beginning of signal pulse train

Measured at Tp2 with good Gnd

Zoom-in showing risetime

Zoom-in showing fall-time

September 2, 2020
Changed Rg = Rf = 249 ohms / added in Riso = 30 ohms / Cf = 6pF

New drive amp with component values indicated above

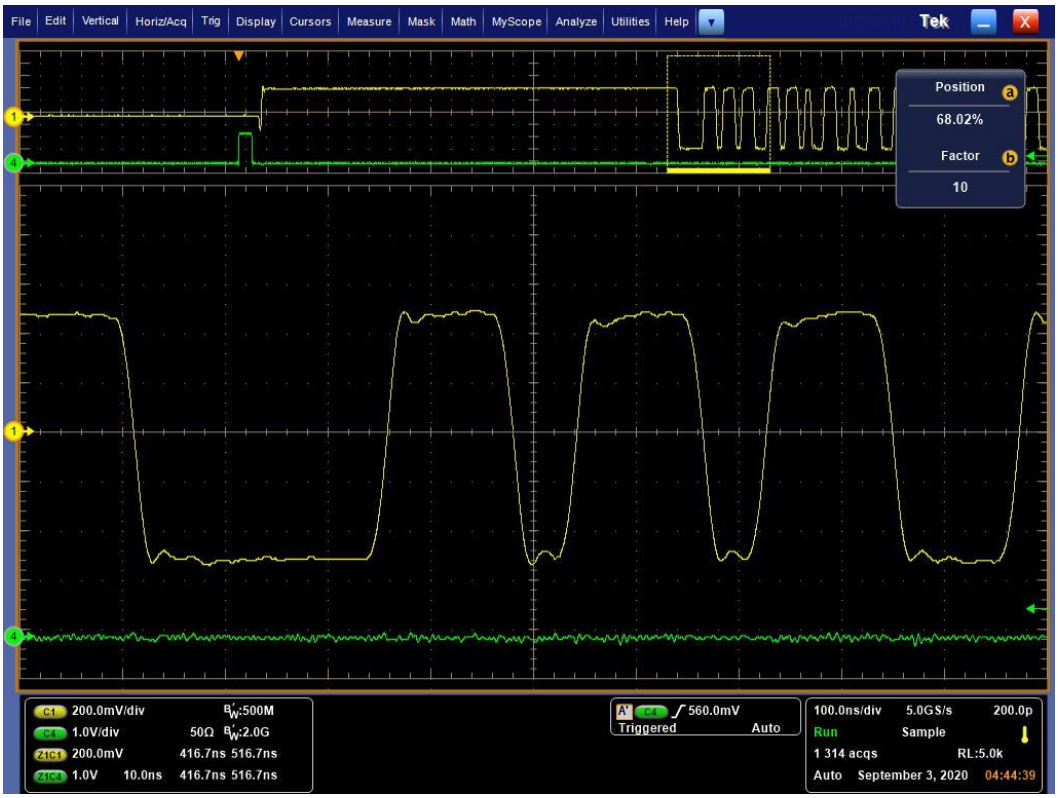
Start of pulse train

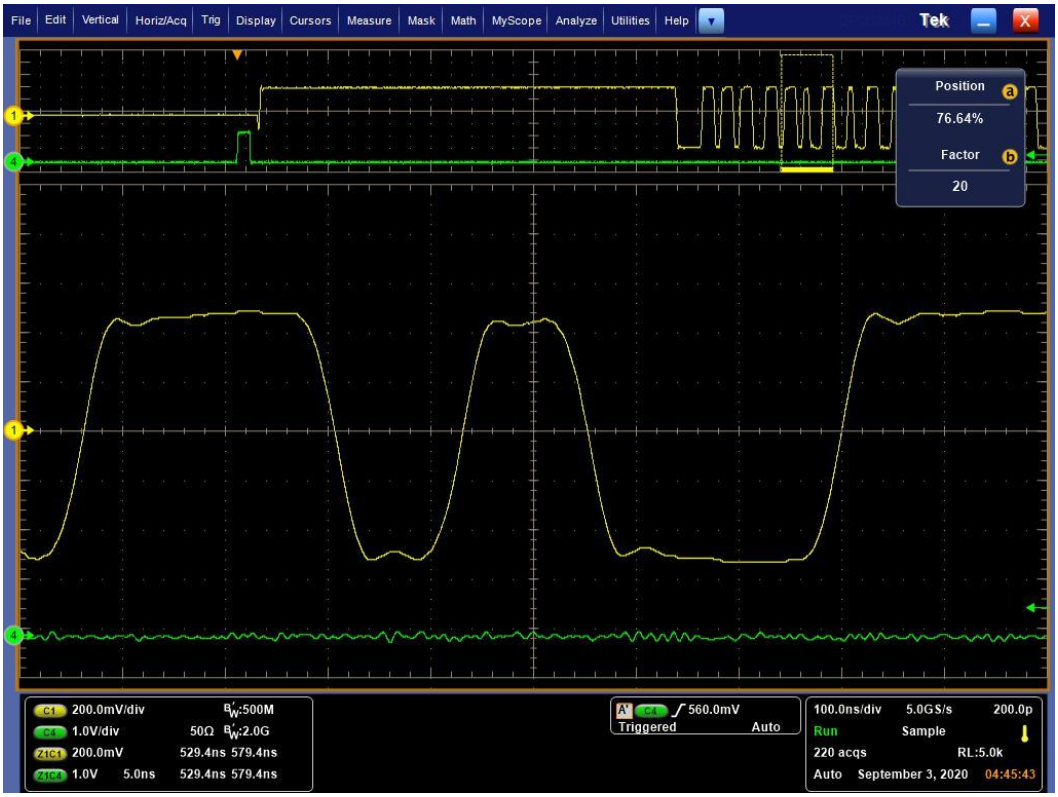
ALL measurements done at Tp2 with low inductance to probe ground

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
451.28ns
Curs2 X Pos
453.26ns
C1 200.0mV/div
C4 1.0V/div
Z1C1 200.0mV
Z1C4 1.0V 5.0ns
50Ω
435.8ns 485.8ns
435.8ns 485.8ns
t1 451.277ns
t2 453.257ns
Δt 1.98ns
1/Δt 505.051MHz
560.0mV
Triggered
Auto
100.0ns/div
5.0GS/s
200.0p
Run
Sample
1 165 acqs
RL:5.0k
Auto September 3, 2020 03:44:04

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
451.28ns
Curs2 X Pos
453.26ns
C1 200.0mV/div
C4 1.0V/div
Z1C1 200.0mV
Z1C4 1.0V 5.0ns
50Ω
435.8ns 485.8ns
435.8ns 485.8ns
t1 451.277ns
t2 453.257ns
Δt 1.98ns
1/Δt 505.051MHz
560.0mV
Triggered
Auto
100.0ns/div
5.0GS/s
200.0p
Run
Sample
1 165 acqs
RL:5.0k
Auto September 3, 2020 03:44:04

Changed Cf = 8pF:





File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.13ns
Curs2 X Pos
533.33ns
C1 200.0mV/div
C4 1.0V/div
Z1C1 200.0mV
Z1C4 1.0V 2.0ns
50Ω
521.3ns 541.3ns
521.3ns 541.3ns
t1 531.131ns
t2 533.332ns
Δt 2.2ns
1/Δt 454.504MHz
560.0mV
Triggered
Auto
100.0ns/div
5.0GS/s
200.0p
Run
Sample
896 acqs
RL:5.0k
Auto September 3, 2020 04:46:46
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
543.46ns
Curs2 X Pos
546.17ns
C1 200.0mV/div
C4 1.0V/div
Z1C1 200.0mV
Z1C4 1.0V 2.0ns
50Ω
532.5ns 552.5ns
532.5ns 552.5ns
t1 543.462ns
t2 546.172ns
Δt 2.71ns
1/Δt 369.004MHz
560.0mV
Triggered
Auto
100.0ns/div
5.0GS/s
200.0p
Run
Sample
1 793 acqs
RL:5.0k
Auto September 3, 2020 04:47:31
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 20.0mV Offset:348.8mV B'W:350M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 20.0mV 5.0ns 526.8ns 576.8ns
Z1C4 1.0V 5.0ns 526.8ns 576.8ns
t1 543.462ns
t2 546.172ns
Δt 2.71ns
1/Δt 369.004MHz
A' C4 560.0mV
Triggered Auto
100.0ns/div 5.0GS/s 200.0p
Run Sample
1 310 acqs RL:5.0k
Auto September 3, 2020 04:49:32

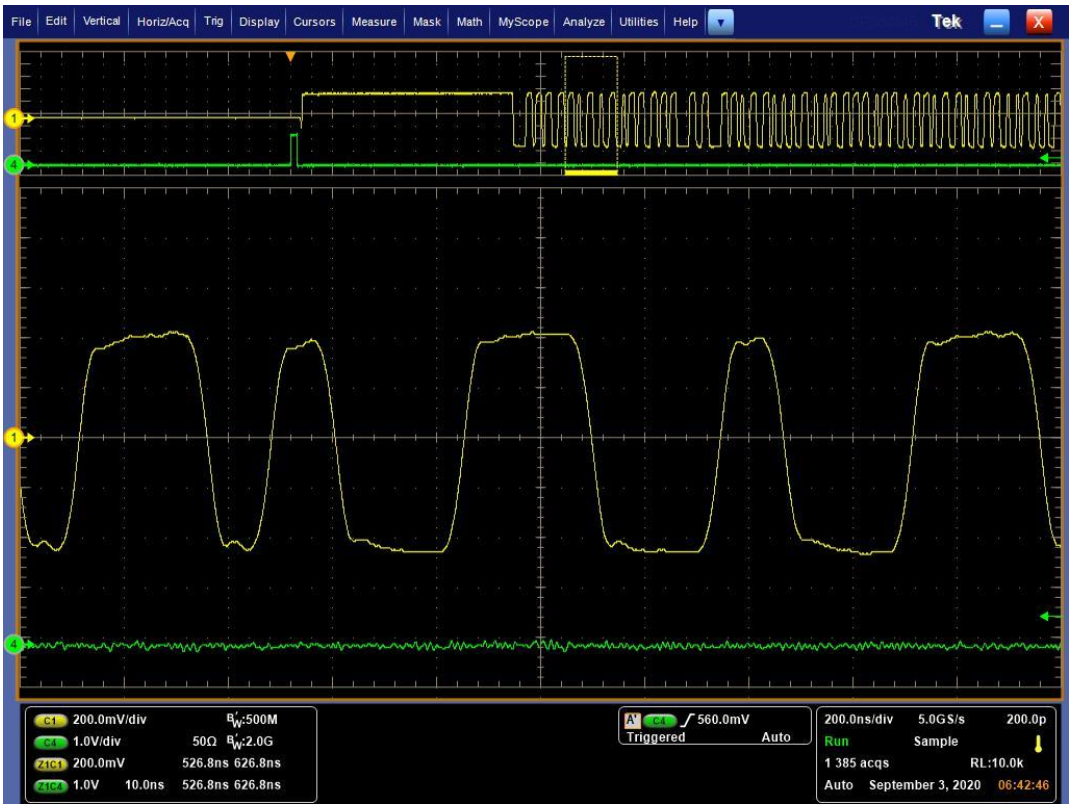
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position a
76.92%
Factor b
20
C1 30.0mV Offset:-558.0m B'W:350M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 30.0mV 5.0ns 521.0ns 571.0ns
Z1C4 1.0V 5.0ns 521.0ns 571.0ns
A' C4 560.0mV
Triggered Auto
100.0ns/div 5.0GS/s 200.0p
Run Sample
739 acqs RL:5.0k
Auto September 3, 2020 04:50:41

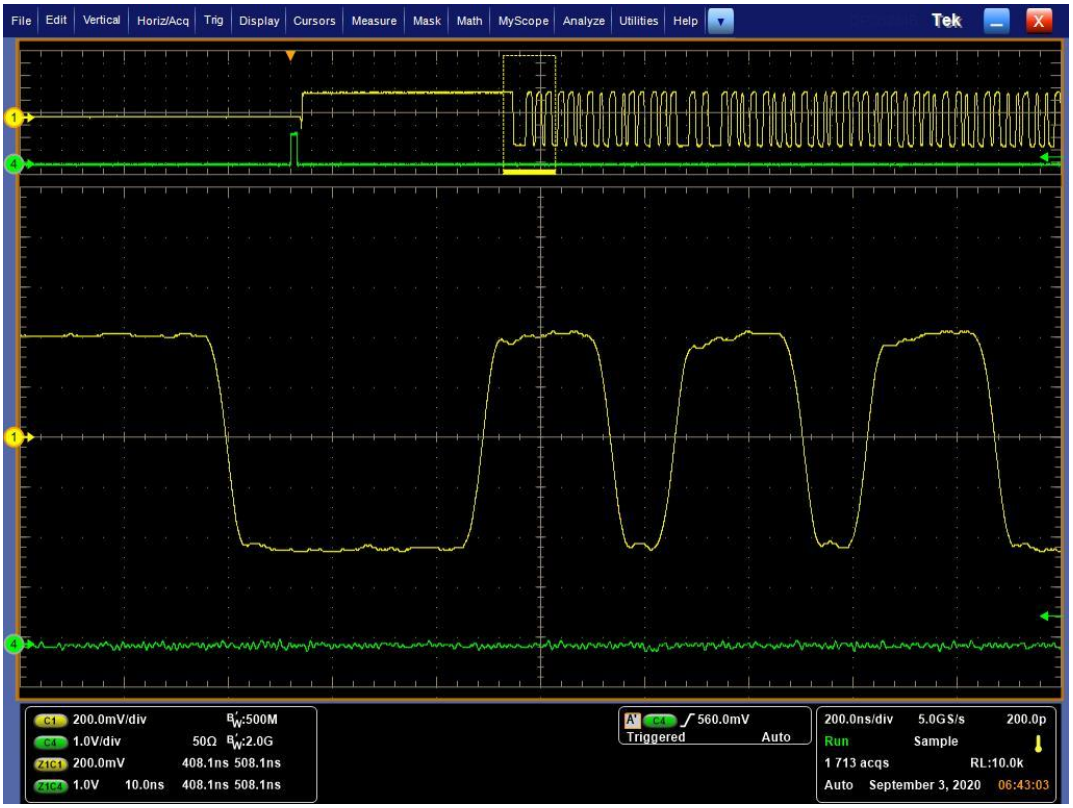
Original Drive Amplifier: Output / Driving with AWG with Booster pattern

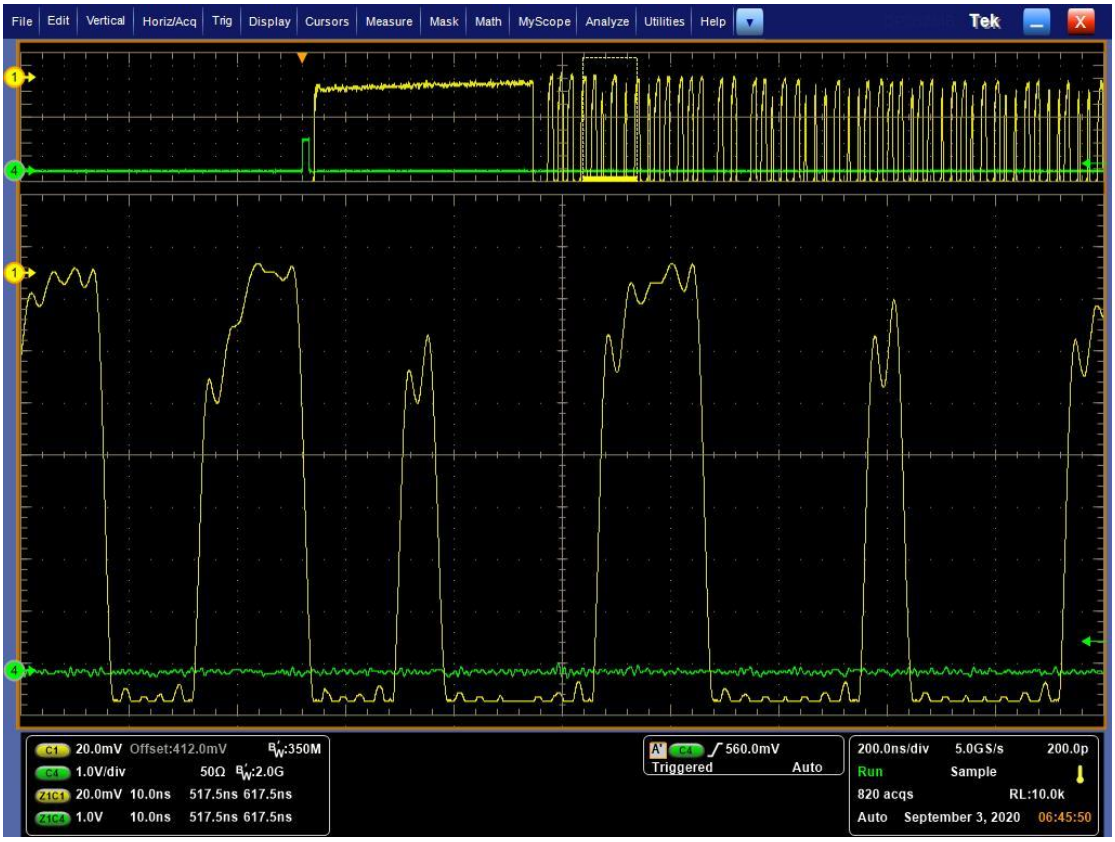
Yellow = Tp2 = Output of U1

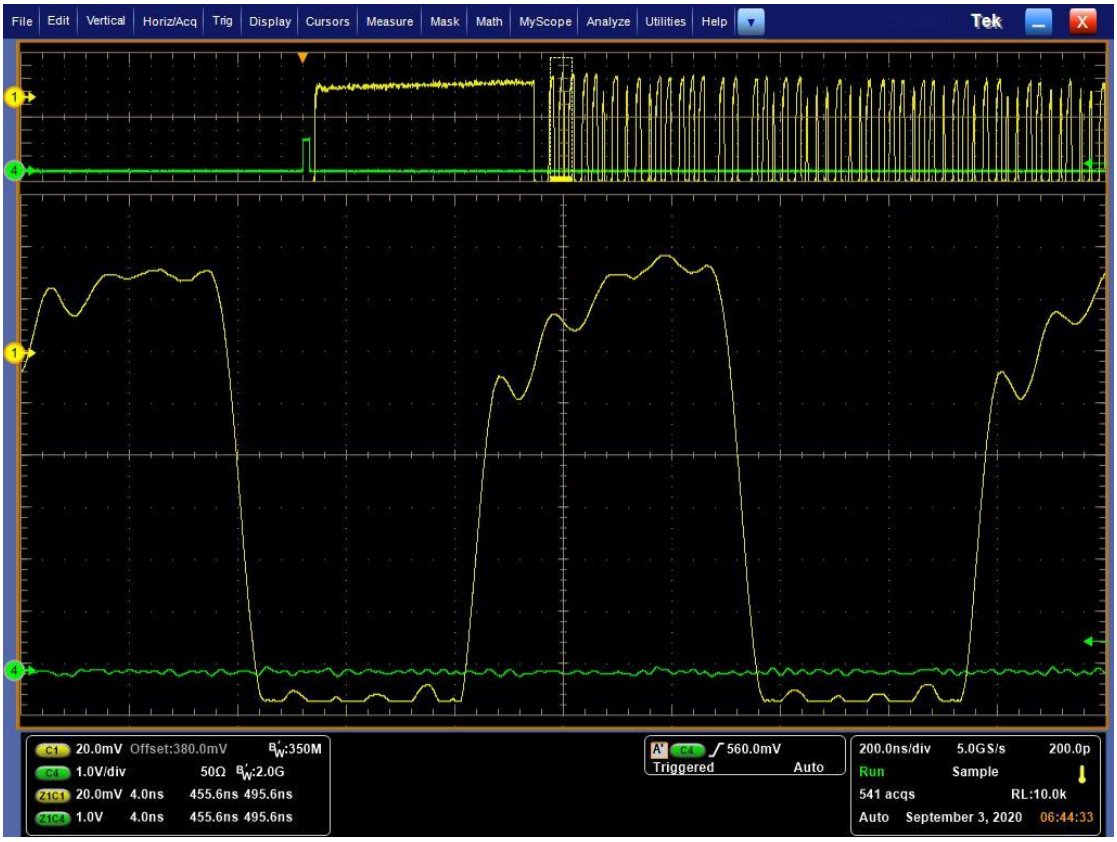
Blue = Tp1 = input to board after 50 ohm resistor / note the overshoot on the ***input*** signal

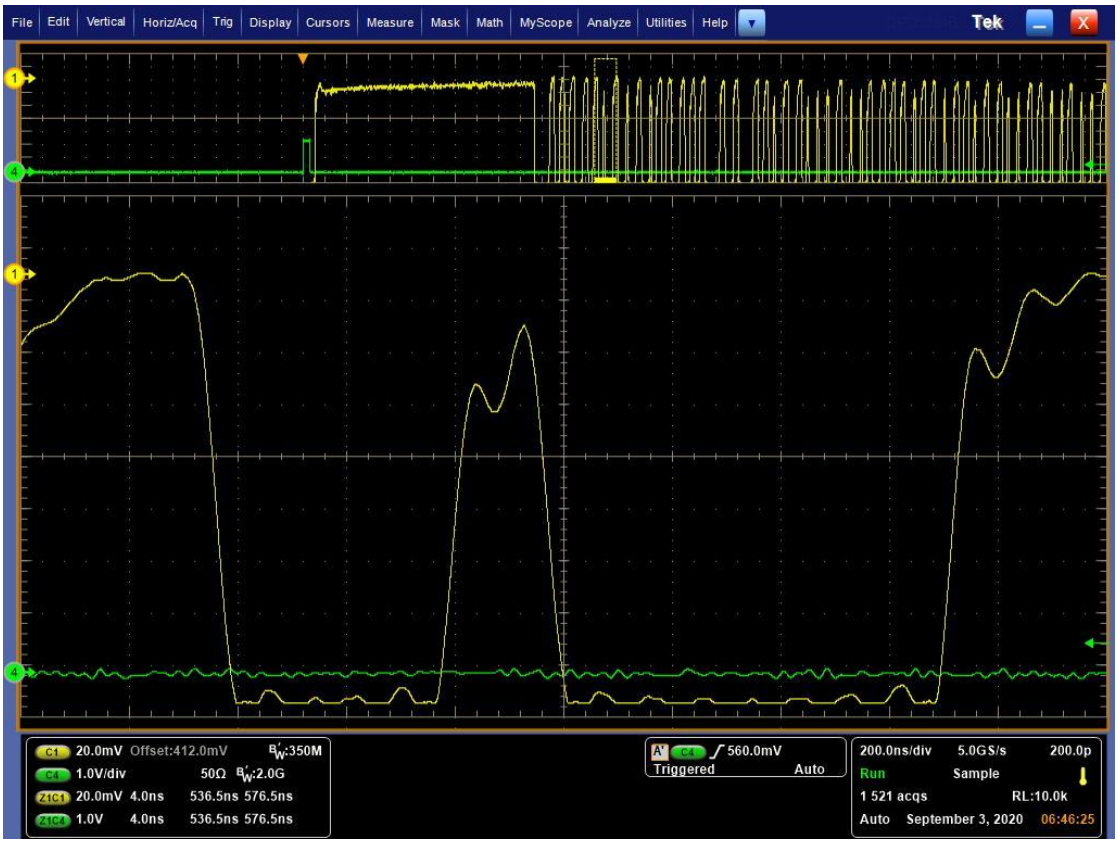
Riso = 49.9 ohms

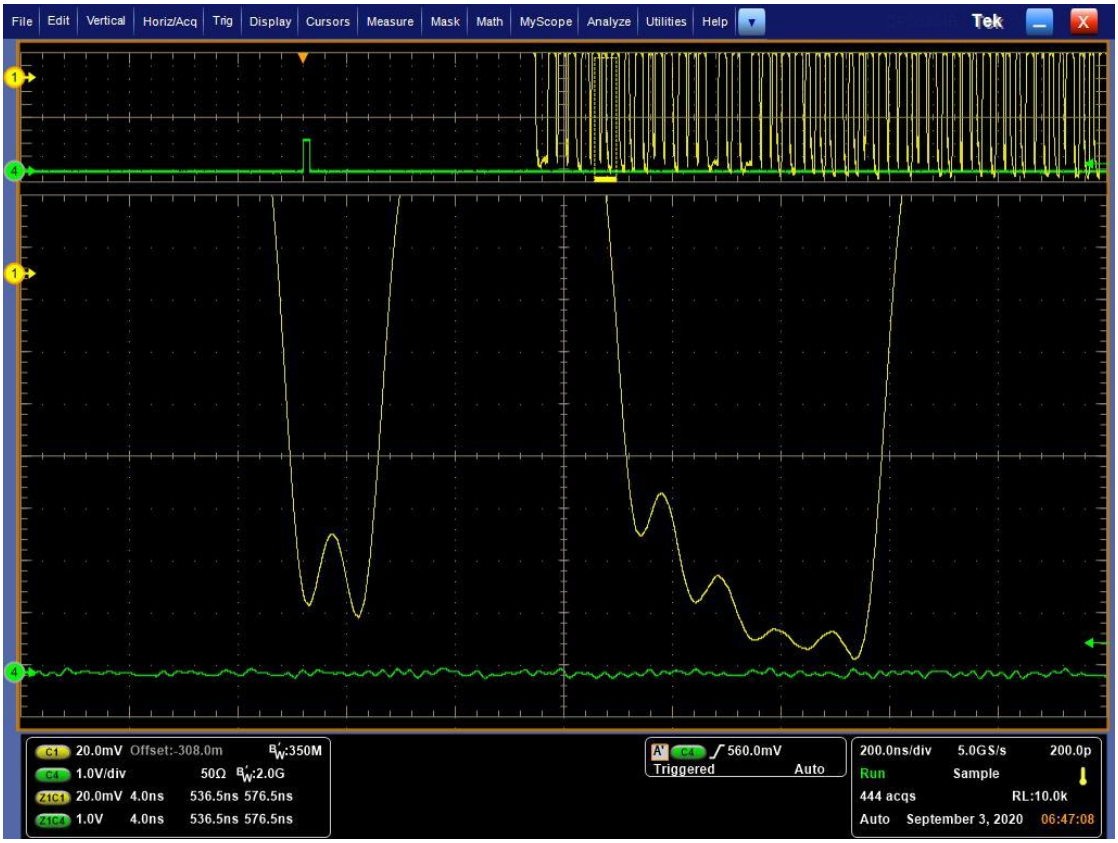





File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 20.0mV Offset:412.0mV BW:350M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 20.0mV 10.0ns 517.5ns 617.5ns
Z1C4 1.0V 10.0ns 517.5ns 617.5ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
820 acqs RL:10.0k
Auto September 3, 2020 06:45:50


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 20.0mV Offset:380.0mV BW:350M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 20.0mV 4.0ns 455.6ns 495.6ns
Z1C4 1.0V 4.0ns 455.6ns 495.6ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
541 acqs RL:10.0k
Auto September 3, 2020 06:44:33


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 20.0mV Offset:412.0mV B'W:350M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 20.0mV 4.0ns 536.5ns 576.5ns
Z1C4 1.0V 4.0ns 536.5ns 576.5ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 521 acqs RL:10.0k
Auto September 3, 2020 06:46:25

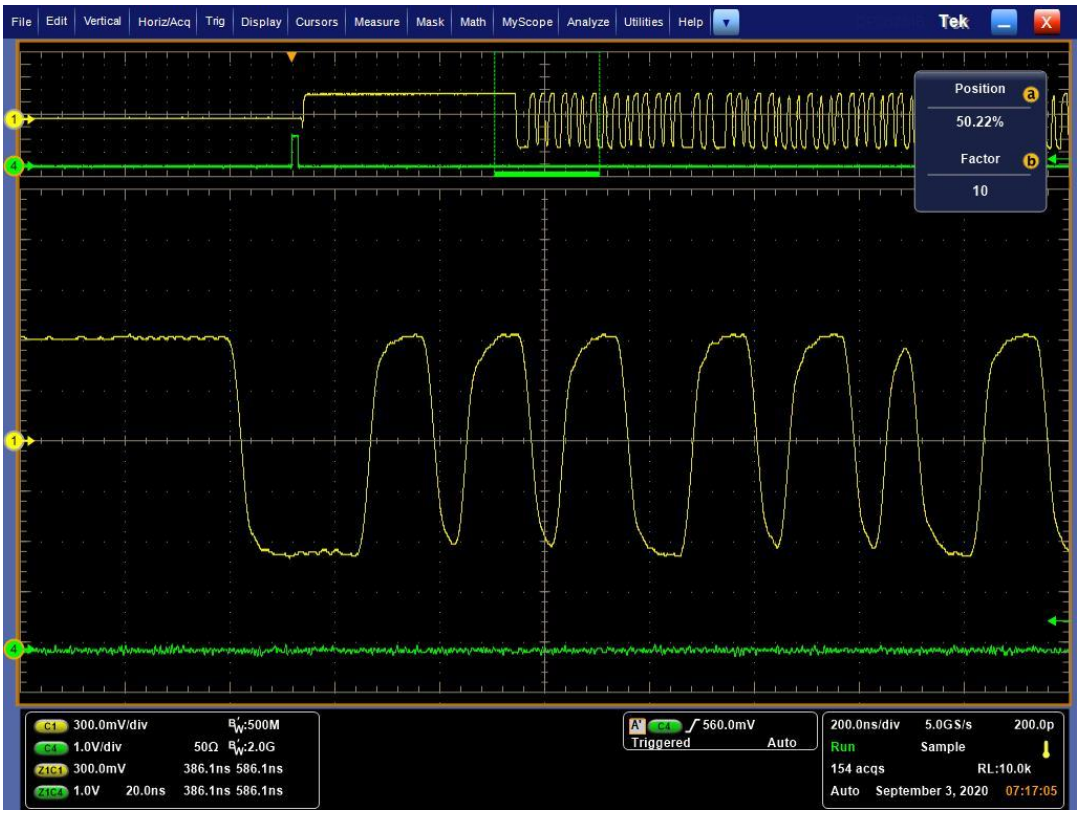

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 20.0mV Offset:-308.0m B'W:350M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 20.0mV 4.0ns 536.5ns 576.5ns
Z1C4 1.0V 4.0ns 536.5ns 576.5ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
444 acqs RL:10.0k
Auto September 3, 2020 06:47:08

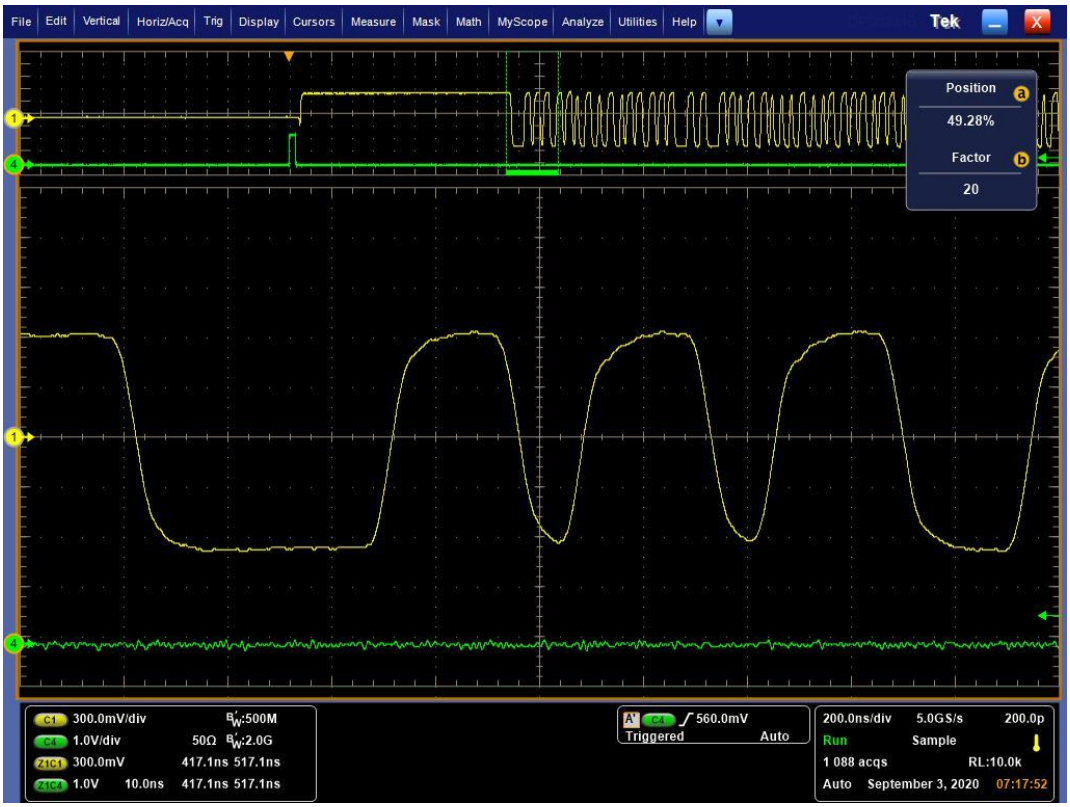
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.46ns
Curs2 X Pos
533.58ns
C1 100.0mV/div
Z1C1 100.0mV
525.1ns 545.1ns
t1 531.463ns
t2 533.583ns
Δt 2.12ns
1/Δt 471.698MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
784 acqs
RL:10.0k
Auto September 3, 2020 06:54:27
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

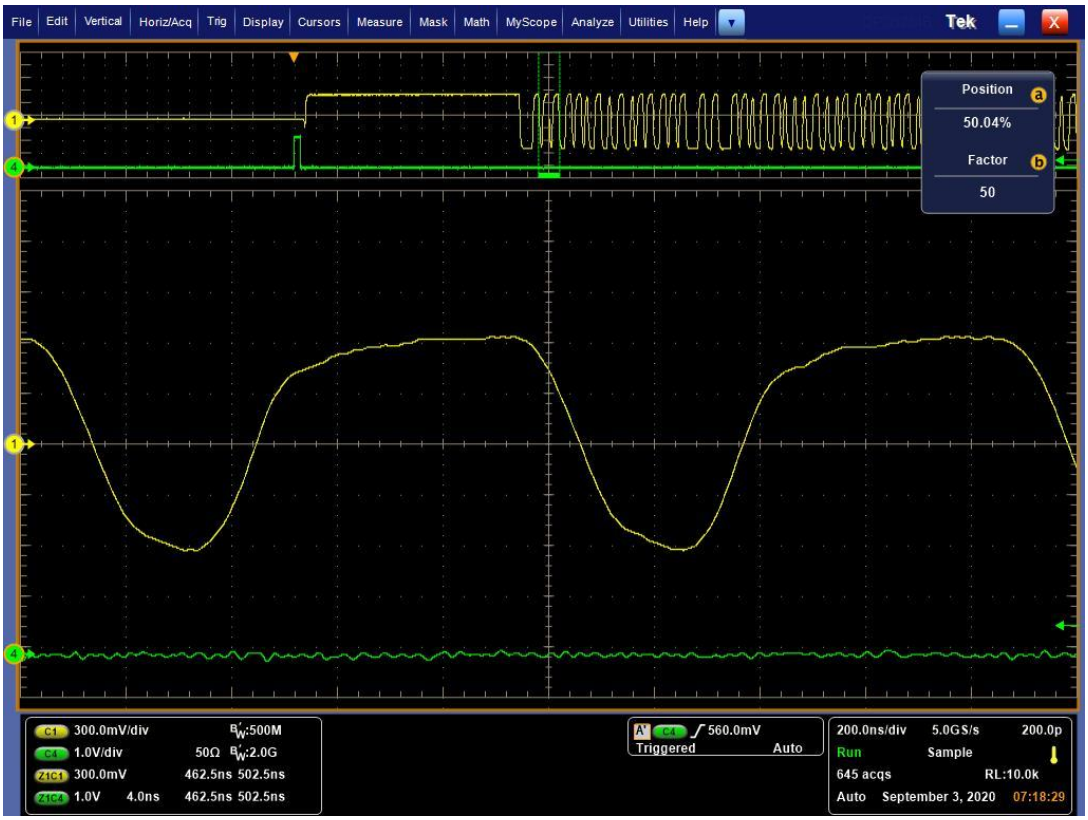
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
543.58ns
Curs2 X Pos
545.82ns
C1 100.0mV/div
Z1C1 100.0mV
532.8ns 552.8ns
t1 543.583ns
t2 545.823ns
Δt 2.24ns
1/Δt 446.429MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
1 801 acqs
RL:10.0k
Auto September 3, 2020 06:55:18
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

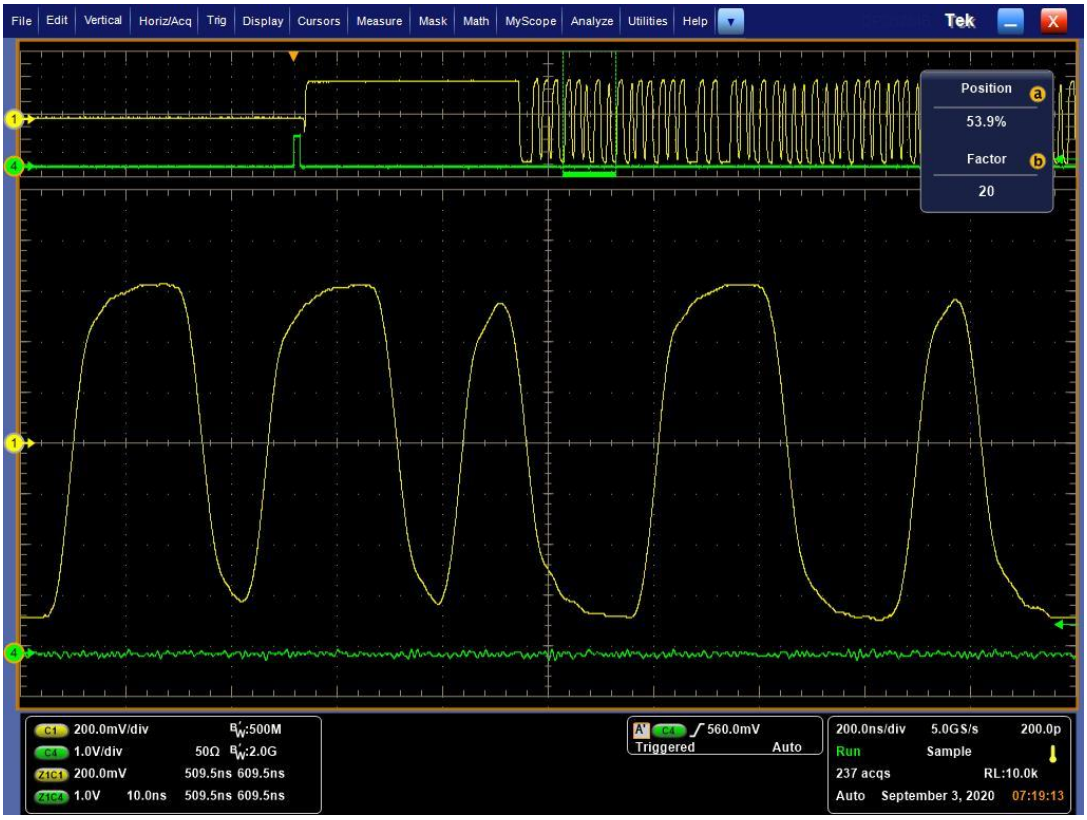
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 100.0mV/div BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 100.0mV 506.5ns 606.5ns
Z1C4 1.0V 10.0ns 506.5ns 606.5ns
A C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
190 acqs RL:10.0k
Auto September 3, 2020 06:48:48

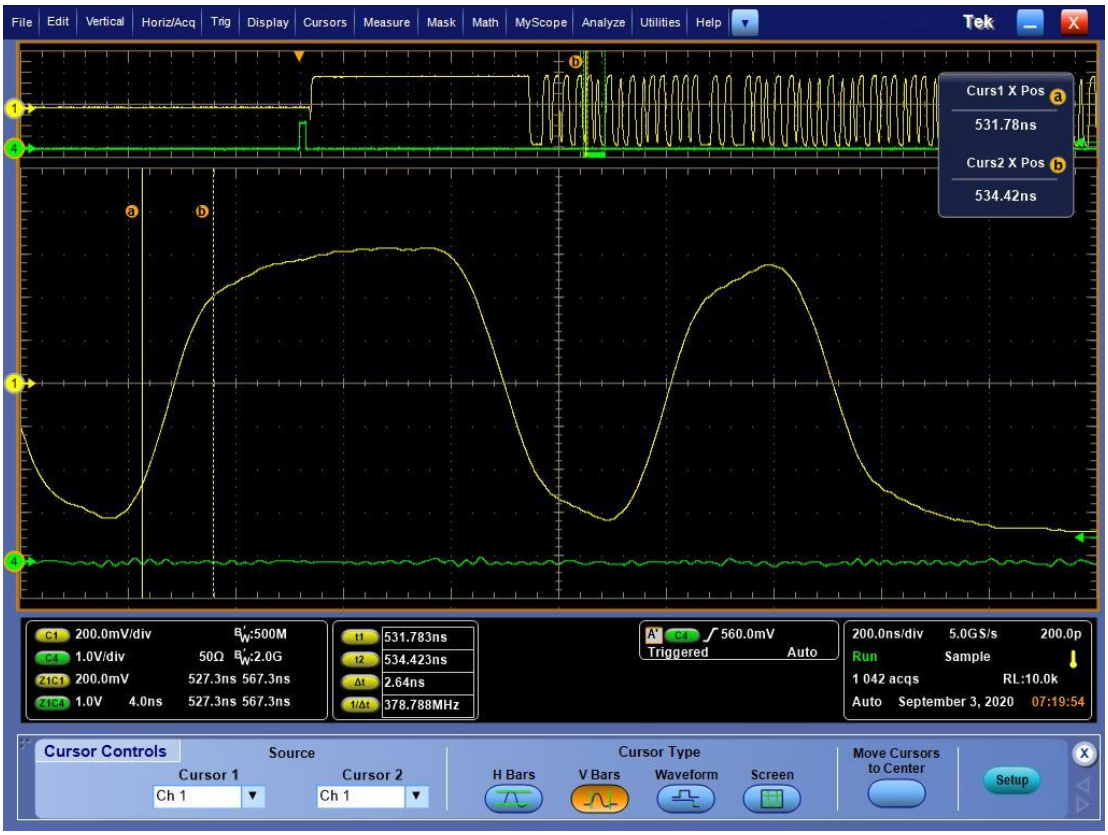
Changed Rg (R2) to 124 ohms, Preamp is now Av = +3

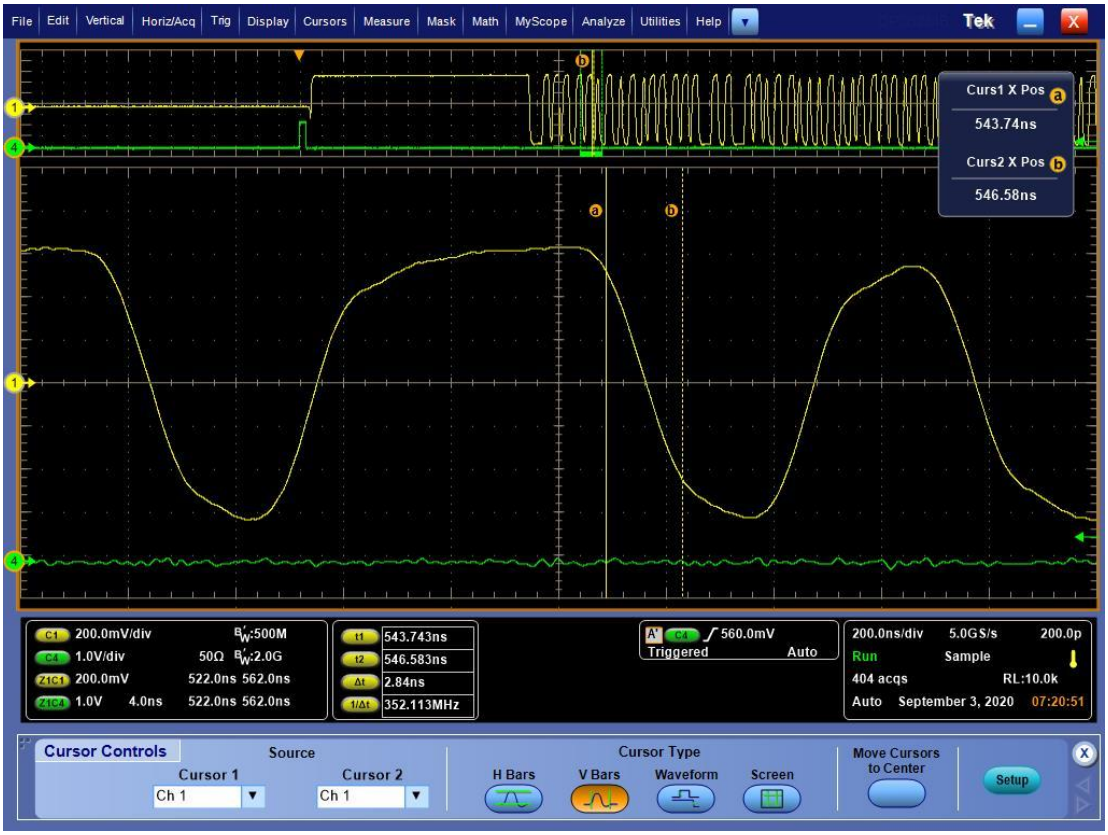




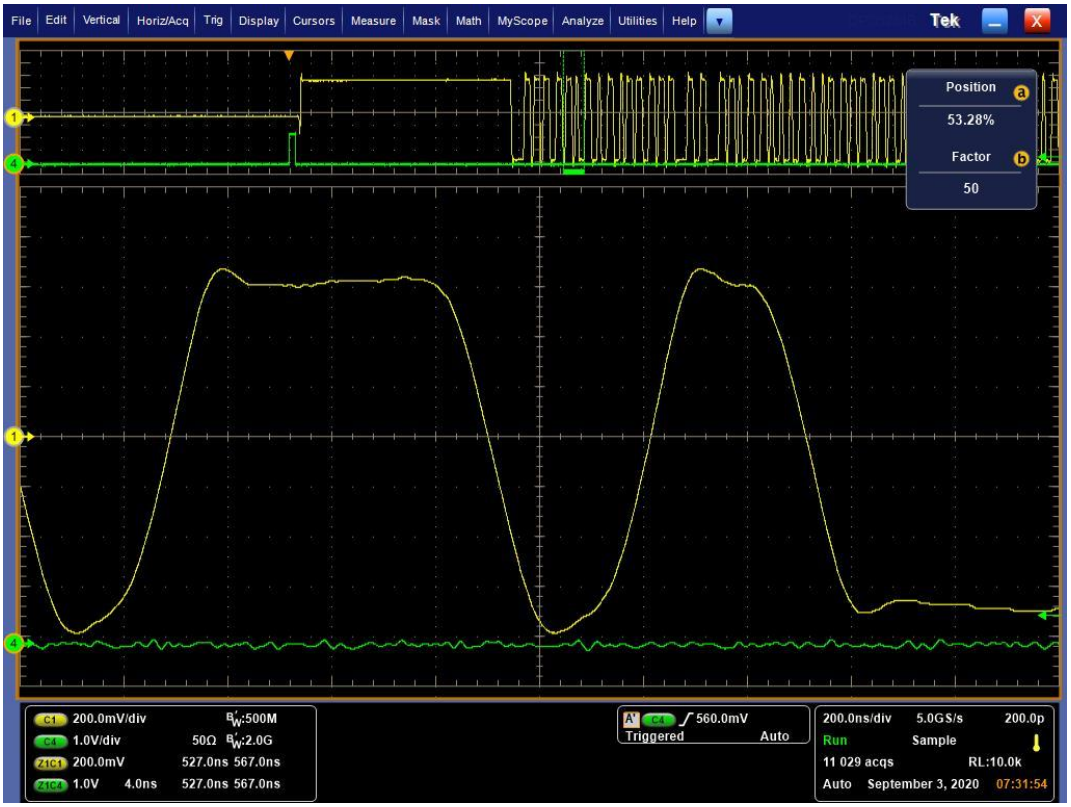

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
50.04%
Factor
50
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 4.0ns
50Ω
462.5ns 502.5ns
462.5ns 502.5ns
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
645 acqs
RL:10.0k
Auto September 3, 2020 07:18:29


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
53.9%
Factor
20
C1 200.0mV/div
C4 1.0V/div
Z1C1 200.0mV
Z1C4 1.0V 10.0ns
50Ω
509.5ns 609.5ns
509.5ns 609.5ns
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
237 acqs
RL:10.0k
Auto September 3, 2020 07:19:13


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.78ns
Curs2 X Pos
534.42ns
C1 200.0mV/div BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 200.0mV 527.3ns 567.3ns
Z1C4 1.0V 4.0ns 527.3ns 567.3ns
t1 531.783ns
t2 534.423ns
Δt 2.64ns
1/Δt 378.788MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 042 acqs RL:10.0k
Auto September 3, 2020 07:19:54
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
543.74ns
Curs2 X Pos
546.58ns
C1 200.0mV/div BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 200.0mV 522.0ns 562.0ns
Z1C4 1.0V 4.0ns 522.0ns 562.0ns
t1 543.743ns
t2 546.583ns
Δt 2.84ns
1/Δt 352.113MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
404 acqs RL:10.0k
Auto September 3, 2020 07:20:51
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

Removed Cf entirely:



File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.1ns
Curs2 X Pos
533.86ns
C1 200.0mV/div BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 200.0mV 527.6ns 547.6ns
Z1C4 1.0V 2.0ns 527.6ns 547.6ns
t1 531.103ns
t2 533.863ns
Δt 2.76ns
1/Δt 362.319MHz
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
13 110 acqs RL:10.0k
Auto September 3, 2020 07:33:38
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
543.86ns
Curs2 X Pos
546.56ns
C1 200.0mV/div BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 200.0mV 532.7ns 552.7ns
Z1C4 1.0V 2.0ns 532.7ns 552.7ns
t1 543.863ns
t2 546.563ns
Δt 2.7ns
1/Δt 370.37MHz
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
13 906 acqs RL:10.0k
Auto September 3, 2020 07:34:18
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

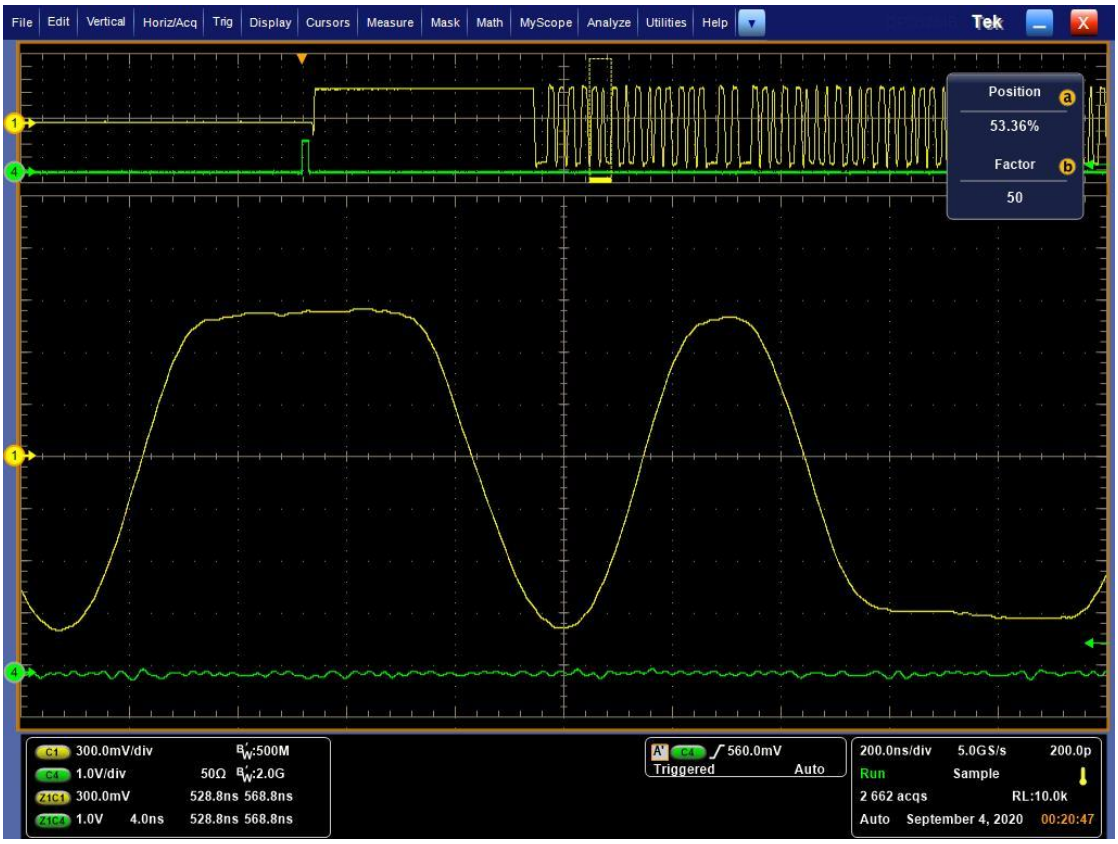
Changed Rg (R2) to 82 ohms / Av = +4, Cf not installed

Yellow = Tp2 = Output of U1

Blue = Tp1 = input to board after 50 ohm resistor / signal amplitudes

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.46ns
Curs2 X Pos
534.76ns
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 2.0ns
50Ω
529.0ns 549.0ns
t1 531.463ns
t2 534.763ns
Δt 3.3ns
1/Δt 303.03MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
4 243 acqs
RL:10.0k
Auto September 4, 2020 00:22:06
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
544ns
Curs2 X Pos
547.32ns
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 2.0ns
50Ω
535.4ns 555.4ns
t1 544.003ns
t2 547.323ns
Δt 3.32ns
1/Δt 301.205MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
581 acqs
RL:10.0k
Auto September 4, 2020 00:22:55
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
53.36%
Factor
50
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 4.0ns
BW:500M
50Ω BW:2.0G
528.8ns 568.8ns
528.8ns 568.8ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 662 acqs RL:10.0k
Auto September 4, 2020 00:20:47

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
49.0%
Factor
50
C1 20.0mV Offset:721.8mV
C4 1.0V/div
Z1C1 20.0mV 4.0ns
Z1C4 1.0V 4.0ns
BW:350M
50Ω BW:2.0G
448.0ns 488.0ns
448.0ns 488.0ns
V1 802.2mV
V2 881.8mV
ΔV 79.6mV
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
446 acqs RL:10.0k
Auto September 4, 2020 00:30:42
Zoom
Scroll
Zoom
Assign Knobs
Horiz
Vert
Area
Zoom 1
Display
On
Zoom Source
Acq
Lock
Show/Hide Waveforms
Setup

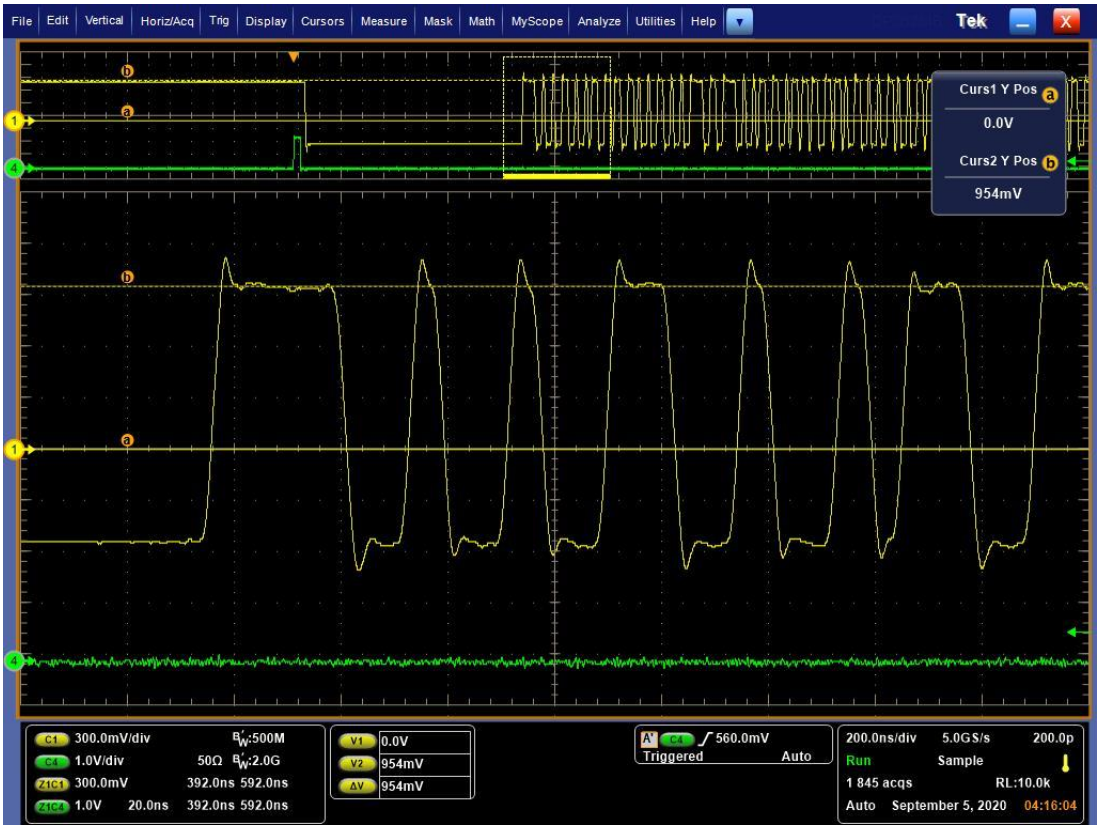
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
781mV
Curs2 Y Pos
887.8mV
C1 20.0mV Offset:721.8mV BW:350M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 20.0mV 4.0ns 448.0ns 488.0ns
Z1C4 1.0V 4.0ns 448.0ns 488.0ns
V1 781mV
V2 887.8mV
ΔV 106.8mV
C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 164 acqs RL:10.0k
Auto September 4, 2020 00:31:56
Zoom
Scroll
Zoom
Assign Knobs
Horiz
Vert
Area
Zoom 1
Display
On
Zoom Source
Acq
Lock
Show/Hide Waveforms
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
781mV
Curs2 Y Pos
887.8mV
C1 20.0mV Offset:721.8mV BW:350M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 20.0mV 4.0ns 448.0ns 488.0ns
Z1C4 1.0V 4.0ns 448.0ns 488.0ns
V1 781mV
V2 887.8mV
ΔV 106.8mV
C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
38 058 acqs RL:10.0k
Auto September 4, 2020 01:02:41
Zoom
Scroll
Zoom
Assign Knobs
Horiz
Vert
Area
Zoom 1
Display
On
Zoom Source
Acq
Lock
Show/Hide Waveforms
Setup

Changed Rg (R2) to 124 ohms and change Riso from 49.9 to 30 ohms

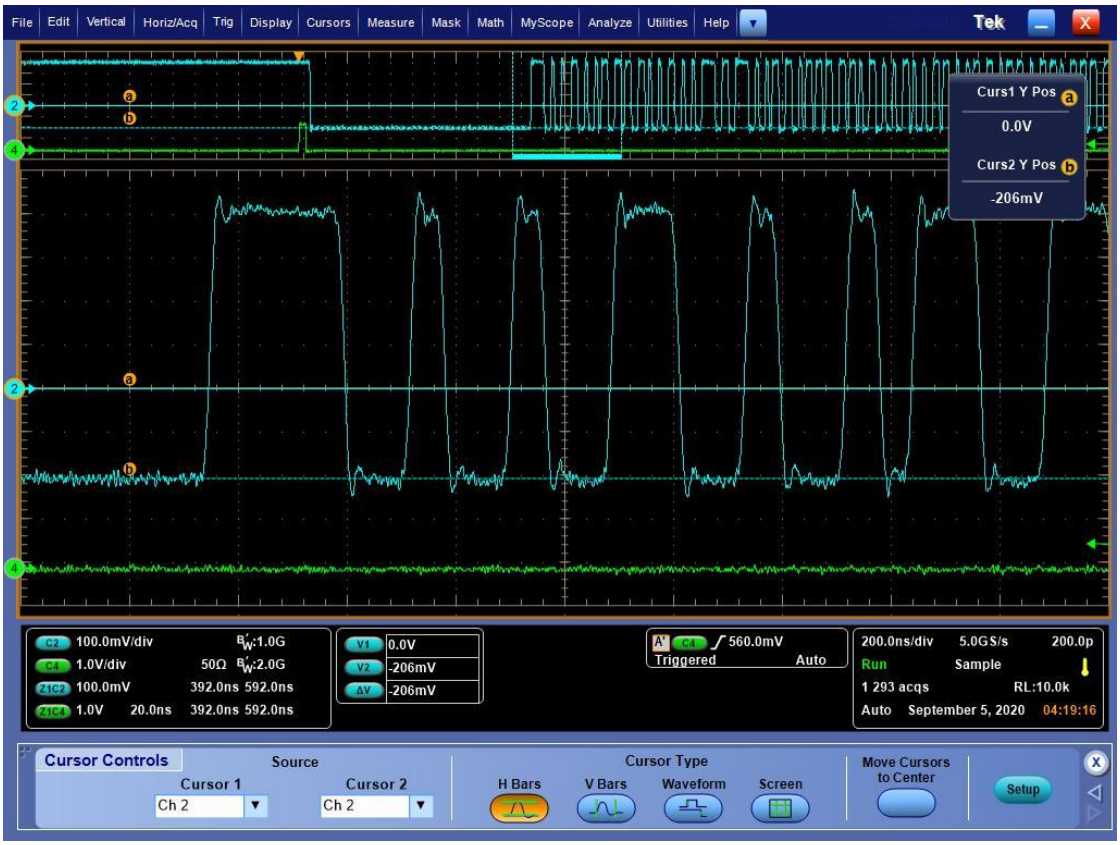
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos a
482.48ns
Curs2 X Pos b
484.84ns
C1 300.0mV/div B'W:500M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 300.0mV 472.0ns 512.0ns
Z1C4 1.0V 4.0ns 472.0ns 512.0ns
t1 482.483ns
t2 484.843ns
Δt 2.36ns
1/Δt 423.729MHz
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 117 acqs RL:10.0k
Auto September 5, 2020 04:13:18
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos a
488.24ns
Curs2 X Pos b
490.8ns
C1 300.0mV/div B'W:500M
C4 1.0V/div 50Ω B'W:2.0G
Z1C1 300.0mV 472.0ns 512.0ns
Z1C4 1.0V 4.0ns 472.0ns 512.0ns
t1 488.243ns
t2 490.803ns
Δt 2.56ns
1/Δt 390.625MHz
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 677 acqs RL:10.0k
Auto September 5, 2020 04:12:56
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup



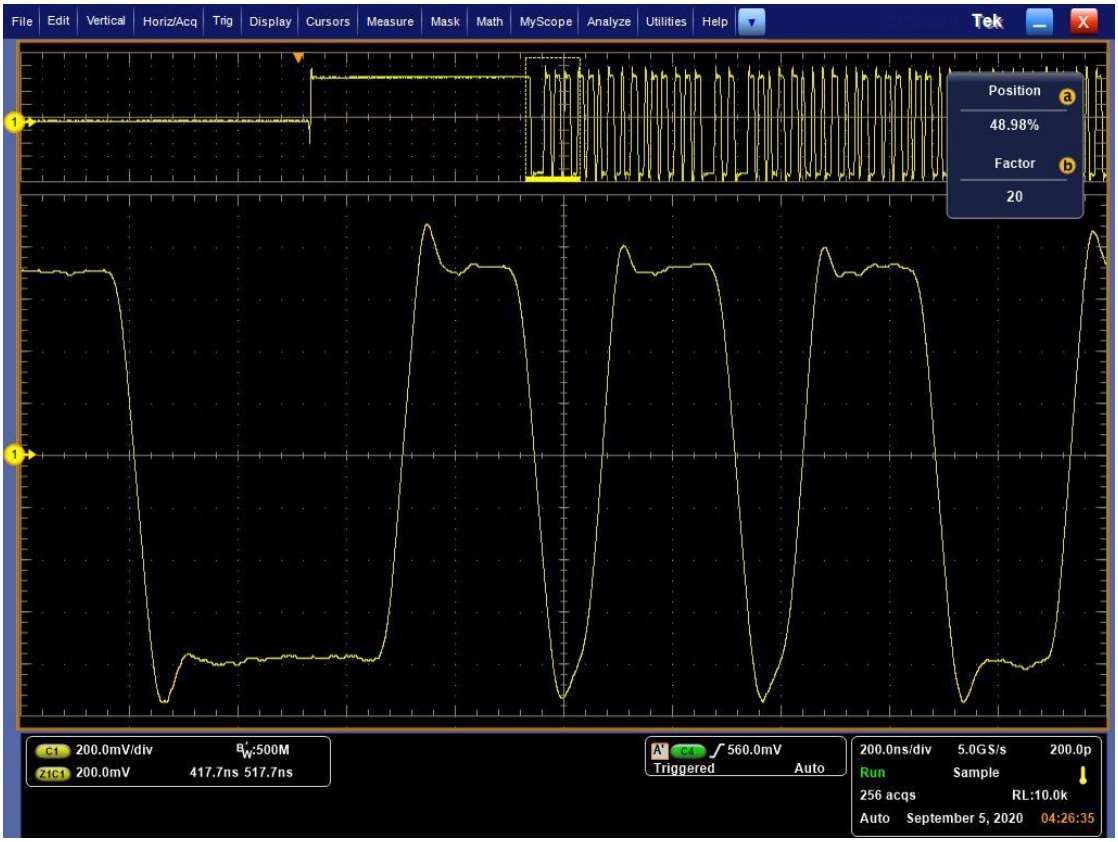
Noticed that waveform was asymmetrical about 0V WRT voltage swing

Coming out of the AWG this way, related to the SW and probably the changes I made to create a bipolar swing



Un-inverted the AWG output in SW

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
50.2%
Factor
10
C1 300.0mV/div
C2 100.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C2 100.0mV
Z1C4 1.0V
392.0ns 592.0ns
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
641 acqs
RL:10.0k
Auto September 5, 2020 04:25:29

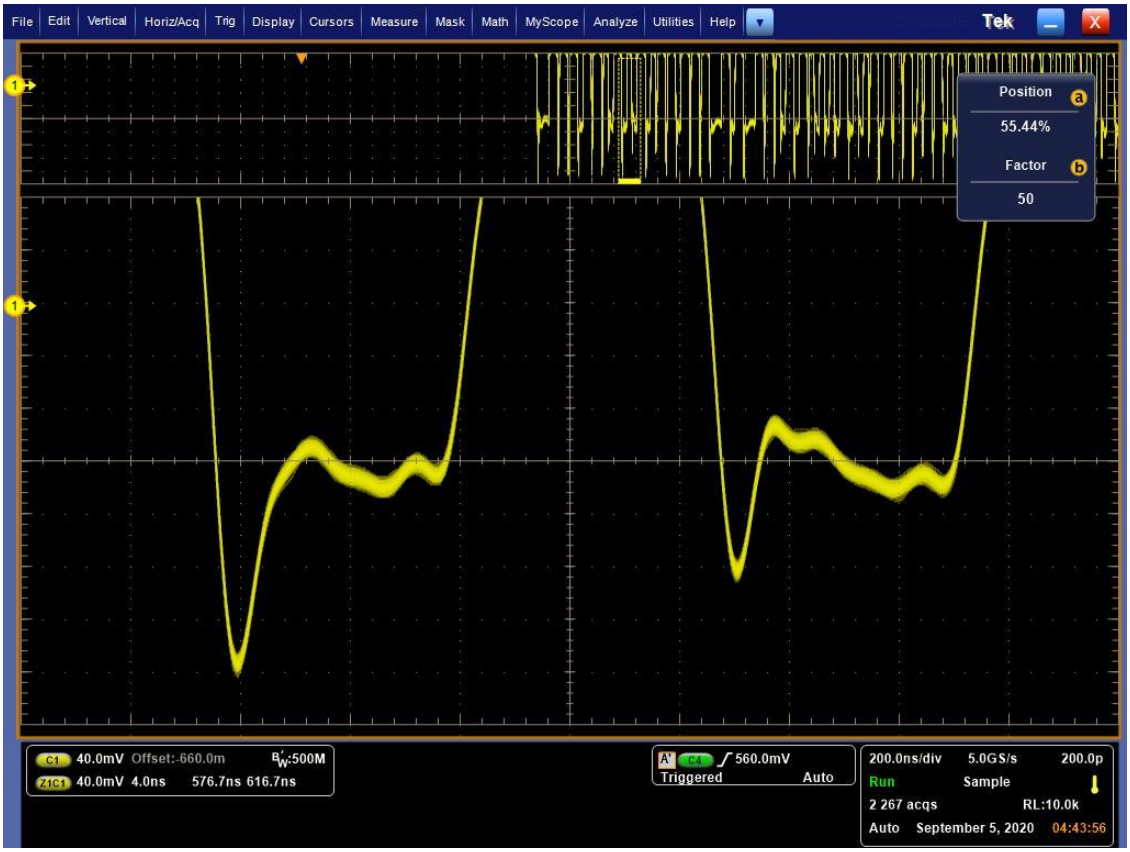

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
48.98%
Factor
20
C1 200.0mV/div
Z1C1 200.0mV
417.7ns 517.7ns
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
256 acqs
RL:10.0k
Auto September 5, 2020 04:26:35

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
704.4mV
Curs2 Y Pos
854mV
C1 40.0mV Offset:738.0mV BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 40.0mV 10.0ns 545.7ns 645.7ns
Z1C4 1.0V 10.0ns 545.7ns 645.7ns
V1 704.4mV
V2 854mV
ΔV 149.6mV
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 471 acqs RL:10.0k
Auto September 5, 2020 04:28:50
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
54.66%
Factor
50
C1 40.0mV Offset:738.0mV BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 40.0mV 4.0ns 561.2ns 601.2ns
Z1C4 1.0V 4.0ns 561.2ns 601.2ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
4 851 acqs RL:10.0k
Auto September 5, 2020 04:33:43

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
54.48%
Factor
20
C1 40.0mV Offset:738.0mV BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 40.0mV 10.0ns 527.6ns 627.6ns
Z1C4 1.0V 10.0ns 527.6ns 627.6ns
A C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
12 358 acqs RL:10.0k
Auto September 5, 2020 04:39:58

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
-932.8mV
Curs2 Y Pos
-777.8mV
C1 40.0mV Offset:-660.0m BW:500M
C4 1.0V/div 50Ω BW:2.0G
Z1C1 40.0mV 4.0ns 576.7ns 616.7ns
Z1C4 1.0V 4.0ns 576.7ns 616.7ns
V1 -932.8mV
V2 -777.8mV
ΔV 155mV
A C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
569 acqs RL:10.0k
Auto September 5, 2020 04:41:37


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
55.44%
Factor
50
C1 40.0mV Offset:-660.0m BW:500M
ZC1 40.0mV 4.0ns 576.7ns 616.7ns
C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 267 acqs RL:10.0k
Auto September 5, 2020 04:43:56

Put FB1 & FB2 back in (were 0 ohm resistors):

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
50.98%
Factor
10
C1 200.0mV/div
Z1C1 200.0mV
BW:500M
407.7ns 607.7ns
A' C4 560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
474 acqs
RL:10.0k
Auto September 5, 2020 05:35:58

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
-780mV
Curs2 Y Pos
-931.4mV
C1 40.0mV Offset:-778.4m
Z1C1 40.0mV 4.0ns
BW:500M
495.7ns 535.7ns
V1 -780mV
V2 -931.4mV
ΔV -151.4mV
A' C4 560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
322 acqs
RL:10.0k
Auto September 5, 2020 05:34:41
Cursor Controls
Source
Cursor 1
Ch 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

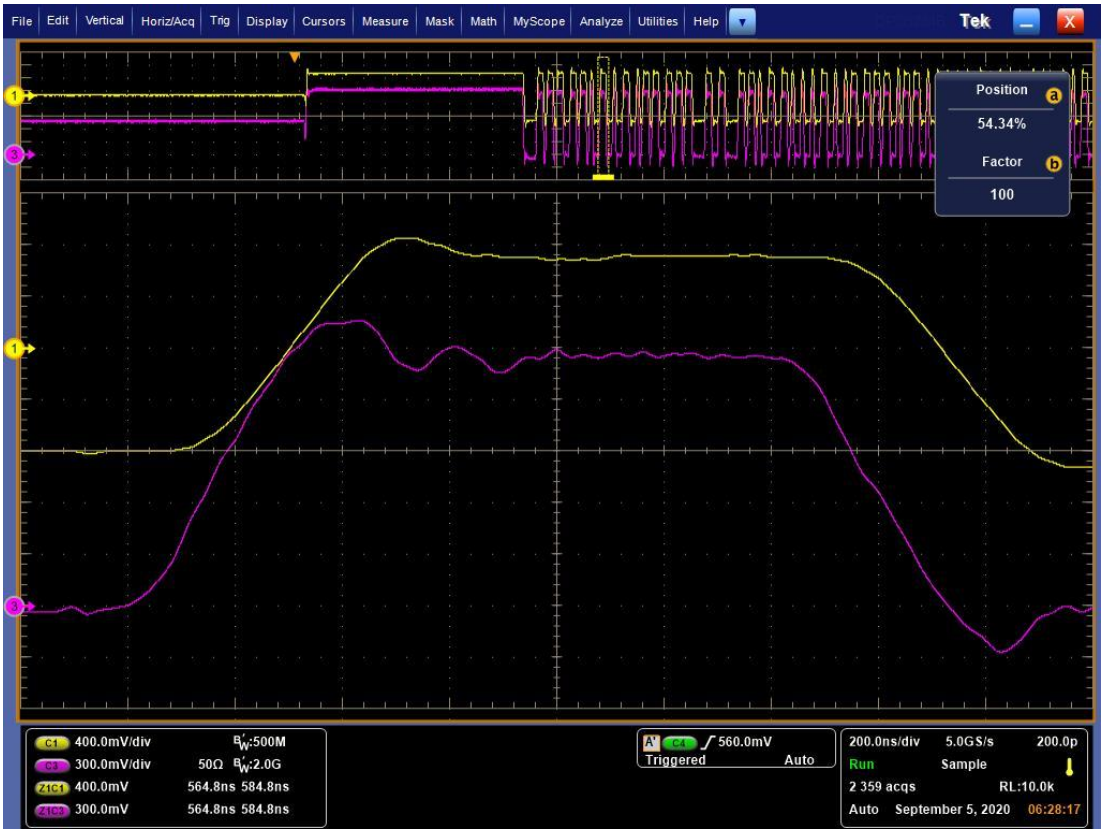
R11 (2.49 ohm resistor) installed again, now driving SE output as well as the monitor and differential circuits (the latter two were already connected).

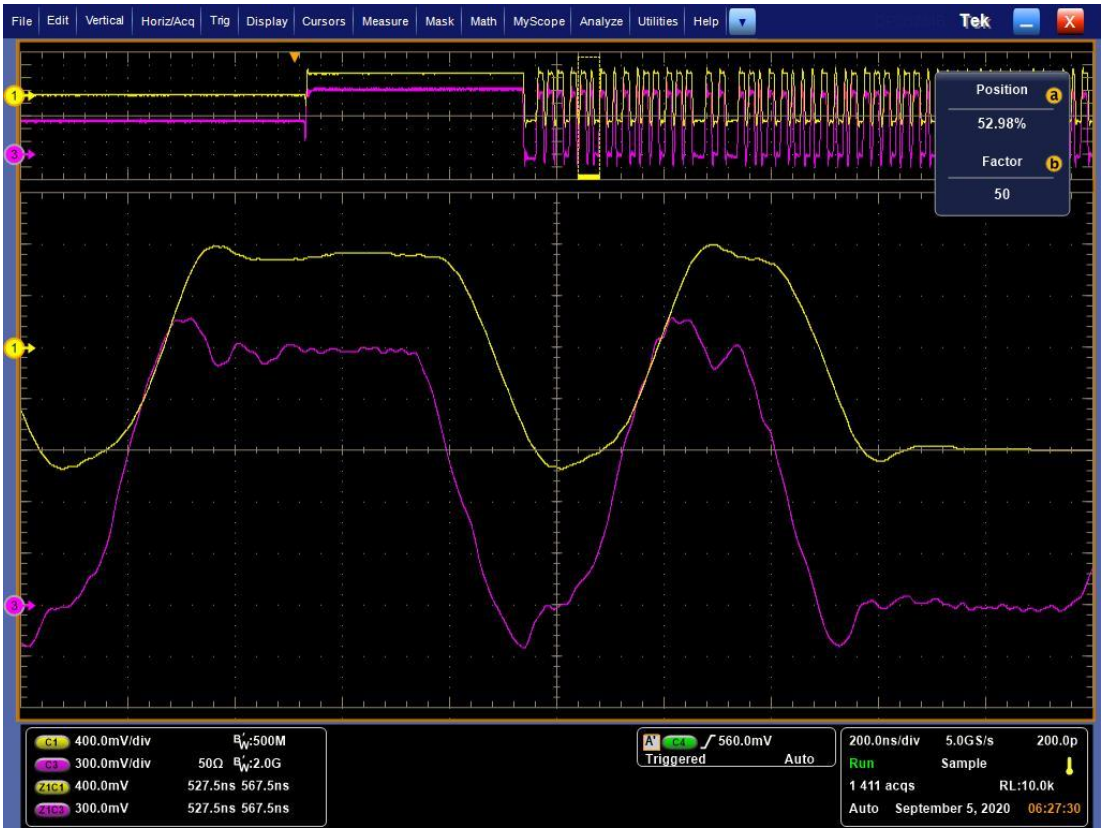
Trace 2: Input form AWG at TP1

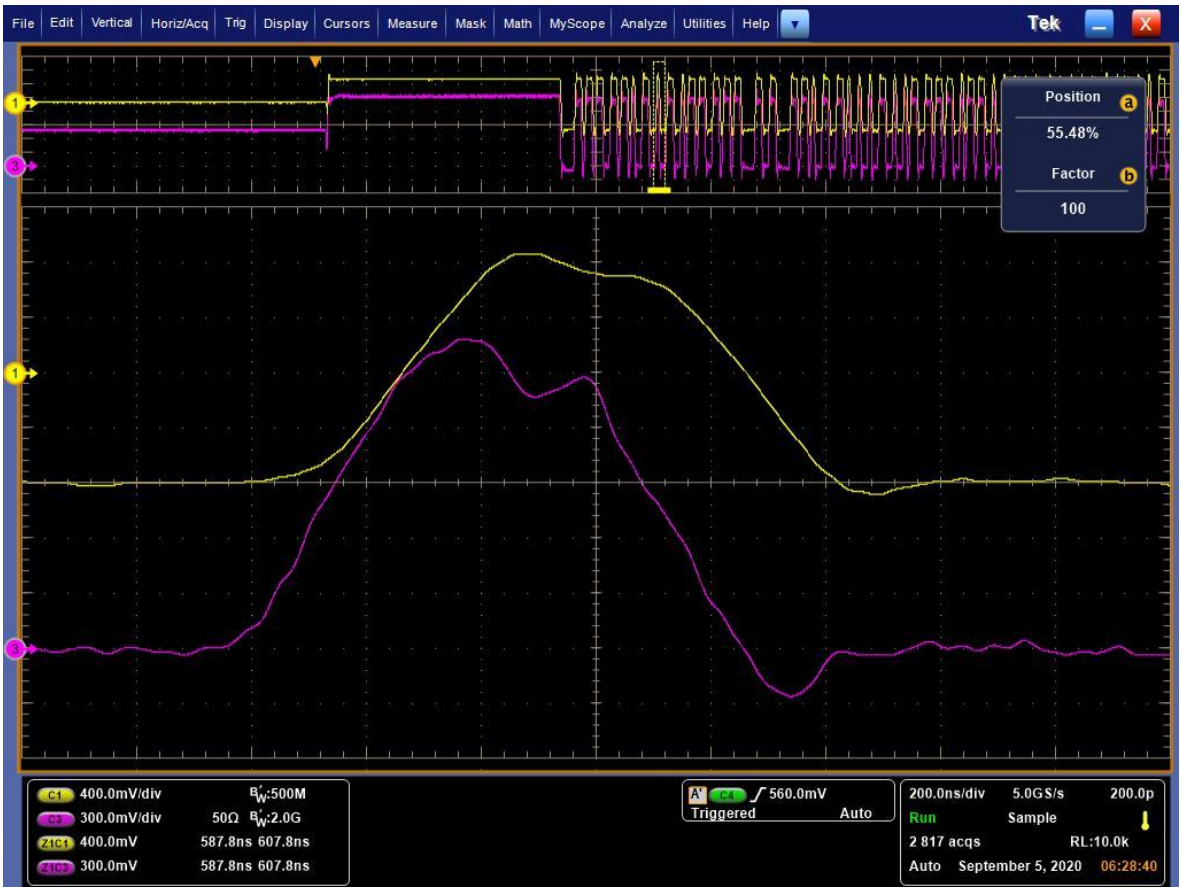
Trace 3: SE out at J3 into scope via RG-58 coax

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
0.0V
Curs2 Y Pos
1.33V
200.0mV/div 50Ω BW:2.0G
200.0mV 457.7ns 557.7ns
V1 0.0V
V2 1.331V
ΔV 1.331V
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
580 acqs RL:10.0k
Auto September 5, 2020 06:26:10

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
49.76%
Factor
20
400.0mV/div BW:500M
300.0mV/div 50Ω BW:2.0G
400.0mV 433.1ns 533.1ns
300.0mV 433.1ns 533.1ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
498 acqs RL:10.0k
Auto September 5, 2020 06:26:44


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
54.34%
Factor
100
C1 400.0mV/div B'W:500M
C3 300.0mV/div 50Ω B'W:2.0G
Z1C1 400.0mV 564.8ns 584.8ns
Z1C3 300.0mV 564.8ns 584.8ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 359 acqs RL:10.0k
Auto September 5, 2020 06:28:17


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
52.98%
Factor
50
C1 400.0mV/div B'W:500M
C3 300.0mV/div 50Ω B'W:2.0G
Z1C1 400.0mV 527.5ns 567.5ns
Z1C3 300.0mV 527.5ns 567.5ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 411 acqs RL:10.0k
Auto September 5, 2020 06:27:30


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
55.48%
Factor
100
C1 400.0mV/div B'W:500M
C3 300.0mV/div 50Ω B'W:2.0G
Z1C1 400.0mV 587.8ns 607.8ns
Z1C3 300.0mV 587.8ns 607.8ns
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 817 acqs RL:10.0k
Auto September 5, 2020 06:28:40

Replace U4 LHM6703 with THS4721: Gain resistor values are the same

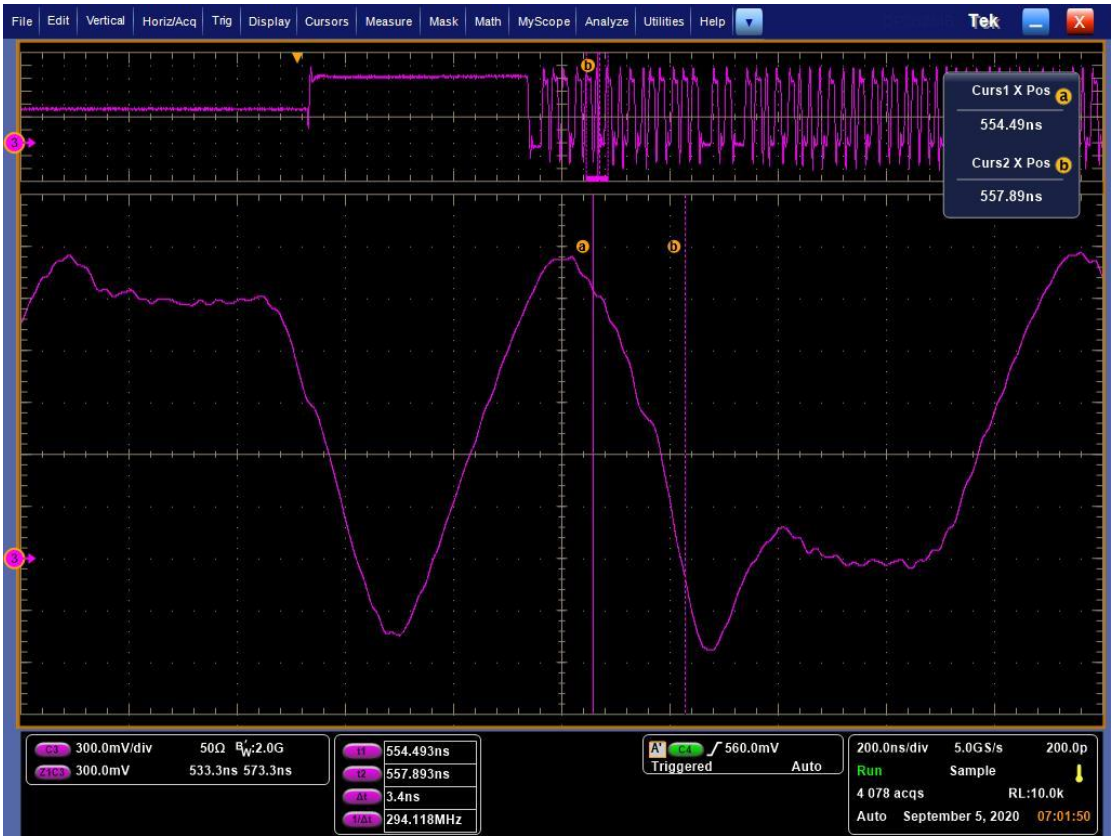
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
51.18%
Factor
20
300.0mV/div 50Ω BW:2.0G
300.0mV 461.7ns 561.7ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
132 acqs RL:10.0k
Auto September 5, 2020 06:56:15

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
512.25ns
Curs2 X Pos
515.85ns
300.0mV/div 50Ω BW:2.0G
300.0mV 499.6ns 539.6ns
t1 512.253ns
t2 515.853ns
Δt 3.6ns
1/Δt 277.778MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 110 acqs RL:10.0k
Auto September 5, 2020 06:59:21
Cursor Controls
Source
Cursor 1
Ch 3
Cursor 2
Ch 3
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
512.25ns
Curs2 X Pos
515.85ns
300.0mV/div 50Ω BW:2.0G
300.0mV 499.6ns 539.6ns
t1 512.253ns
t2 515.853ns
Δt 3.6ns
1/Δt 277.778MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 234 acqs RL:10.0k
Auto September 5, 2020 06:59:27
Cursor Controls
Source
Cursor 1
Ch 3
Cursor 2
Ch 3
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
524.49ns
Curs2 X Pos
527.57ns
300.0mV/div 50Ω BW:2.0G
300.0mV 499.6ns 539.6ns
t1 524.493ns
t2 527.573ns
Δt 3.08ns
1/Δt 324.675MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 784 acqs RL:10.0k
Auto September 5, 2020 06:59:55
Cursor Controls
Source
Cursor 1
Ch 3
Cursor 2
Ch 3
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
548.01ns
Curs2 X Pos
552.13ns
300.0mV/div 50Ω BW:2.0G
300.0mV 533.3ns 573.3ns
t1 548.0ns
t2 552.1ns
Δt 4.12ns
1/Δt 242.7MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
3 652 acqs RL:10.0k
Auto September 5, 2020 07:01:29

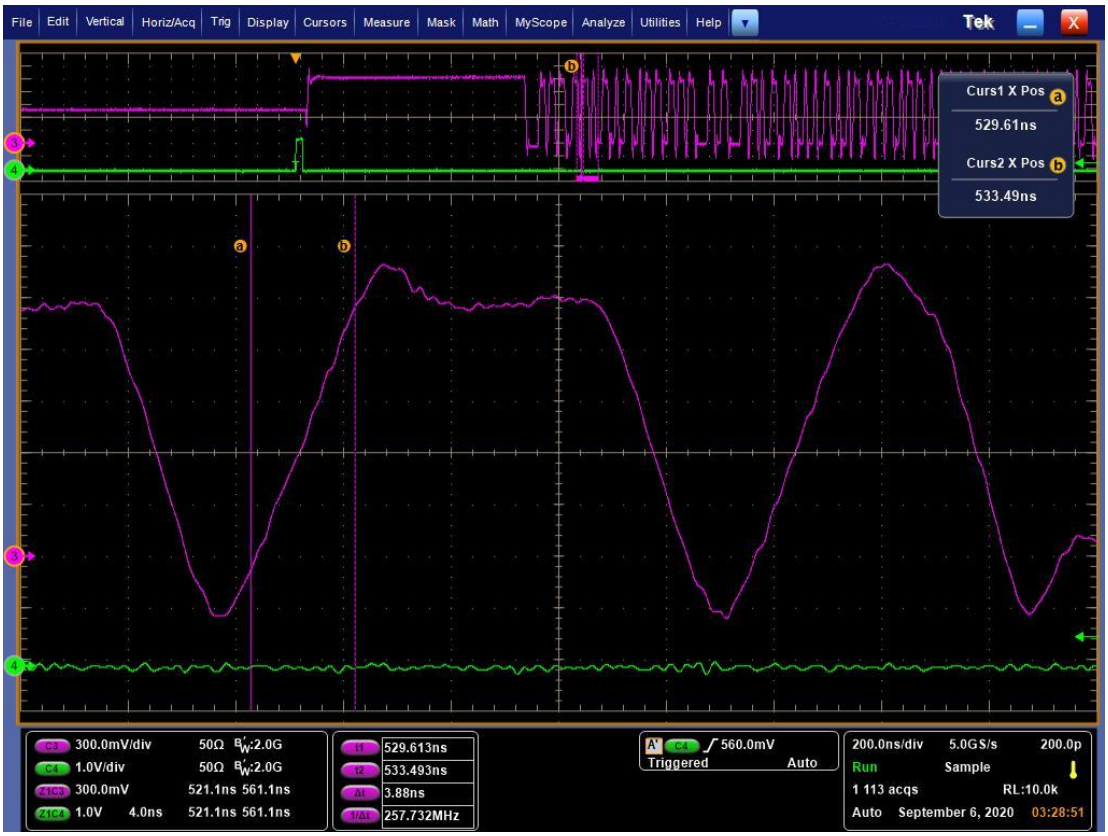

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
554.49ns
Curs2 X Pos
557.89ns
300.0mV/div 50Ω BW:2.0G
300.0mV 533.3ns 573.3ns
t1 554.493ns
t2 557.893ns
Δt 3.4ns
1/Δt 294.118MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
4 078 acqs RL:10.0k
Auto September 5, 2020 07:01:50

U4 = THS4271 / Changes Rg(R10) = Rf(R12) = 249 ohms

Trace 1: U1 output at TP2

Trace 3: SE out at J3 into scope via RG-58 coax

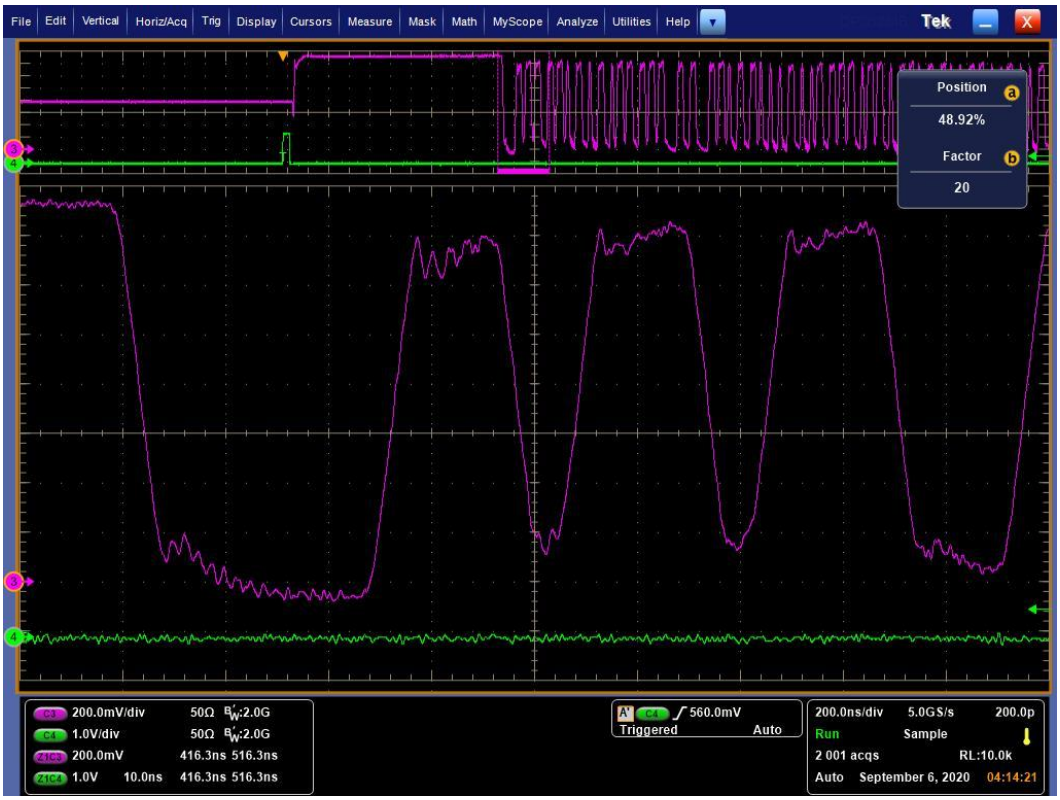
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
52.7%
Factor
20
300.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
300.0mV 492.2ns 592.2ns
1.0V 10.0ns 492.2ns 592.2ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
187 acqs RL:10.0k
Auto September 6, 2020 03:28:04

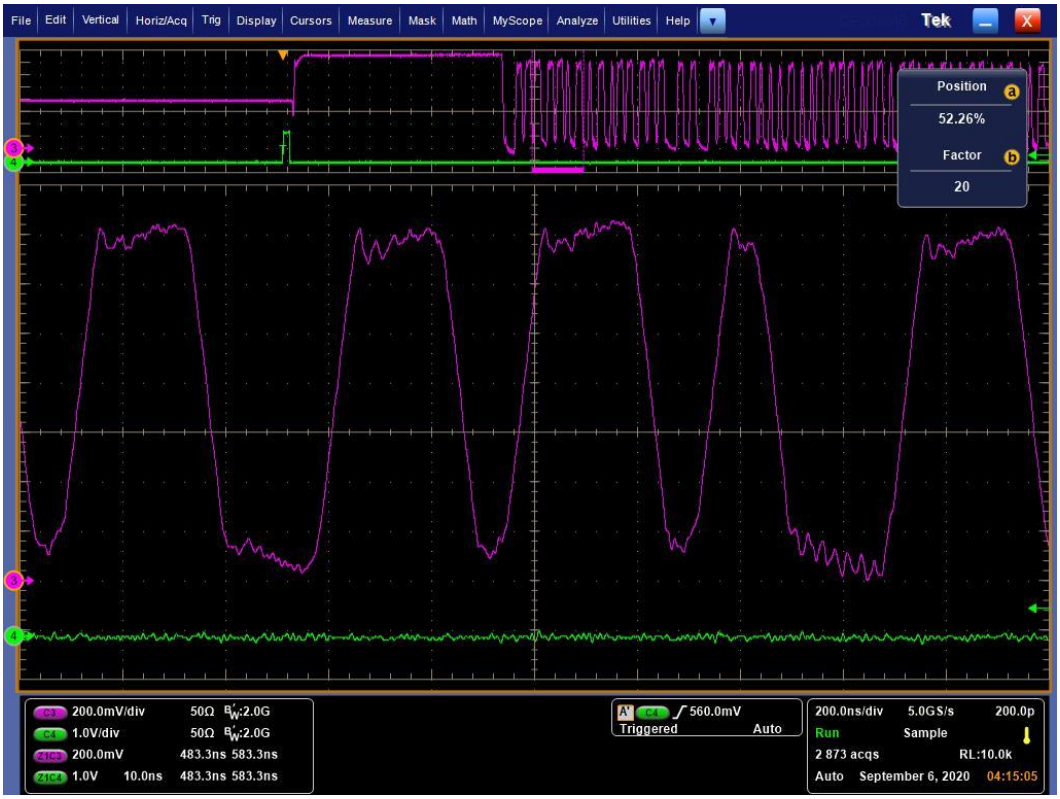

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
529.61ns
Curs2 X Pos
533.49ns
300.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
300.0mV 521.1ns 561.1ns
1.0V 4.0ns 521.1ns 561.1ns
t1 529.613ns
t2 533.493ns
Δt 3.88ns
1/Δt 257.732MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 113 acqs RL:10.0k
Auto September 6, 2020 03:28:51

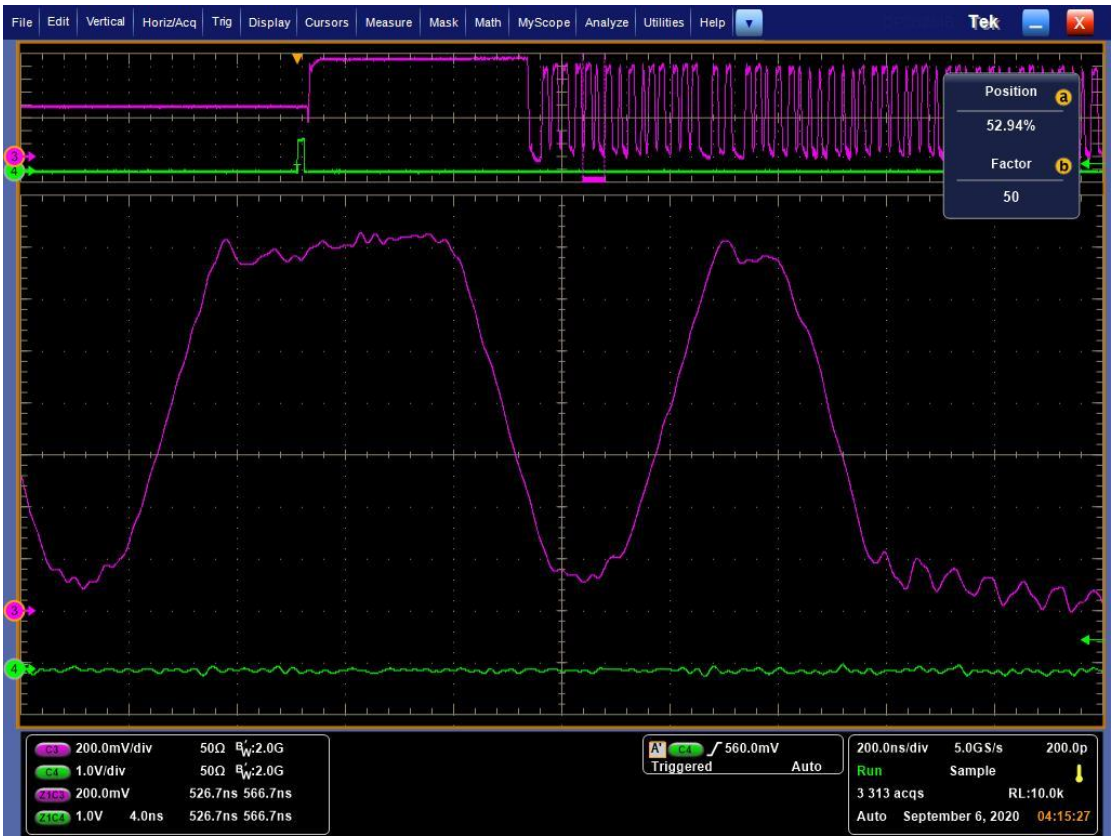
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
529.61ns
Curs2 X Pos
533.49ns
300.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
300.0mV 521.1ns 561.1ns
1.0V 4.0ns 521.1ns 561.1ns
529.613ns
533.493ns
3.88ns
257.732MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 113 acqs RL:10.0k
Auto September 6, 2020 03:28:51

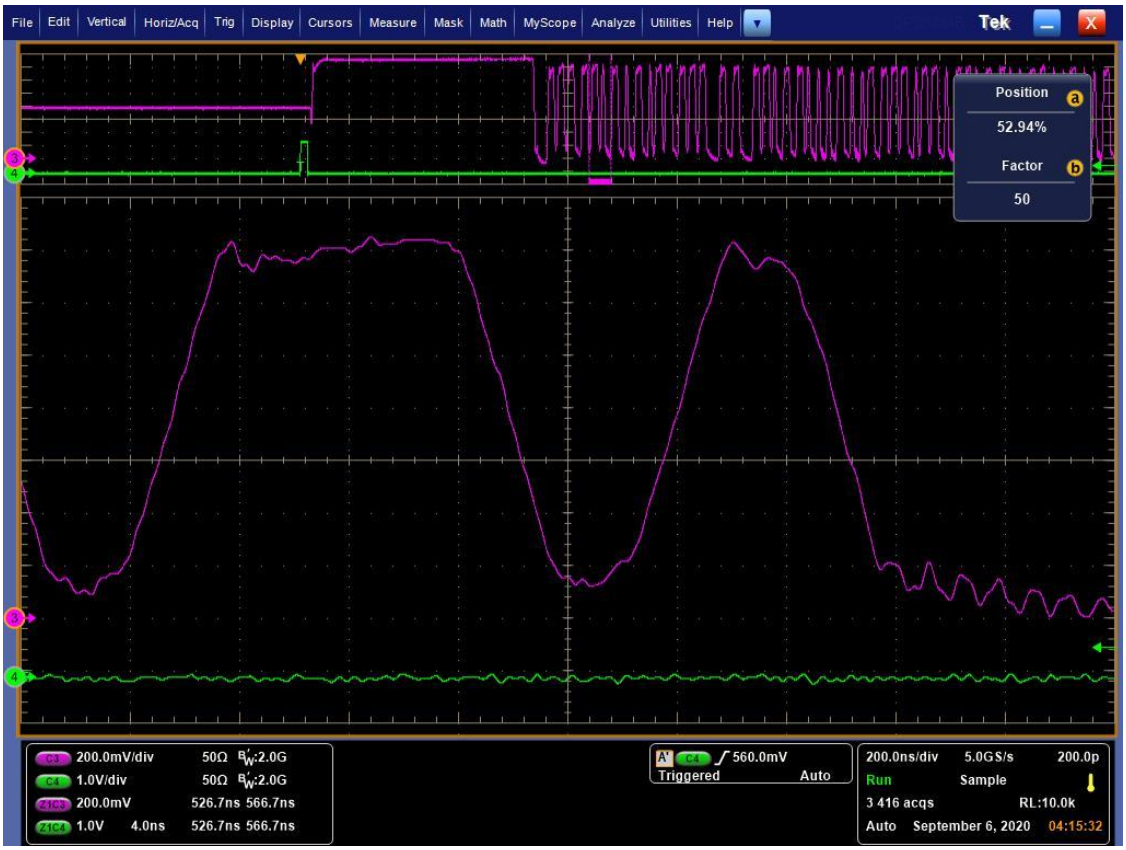
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
554.61ns
Curs2 X Pos
557.69ns
300.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
300.0mV 521.8ns 561.8ns
1.0V 4.0ns 521.8ns 561.8ns
554.613ns
557.693ns
3.08ns
324.675MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 437 acqs RL:10.0k
Auto September 6, 2020 03:29:57

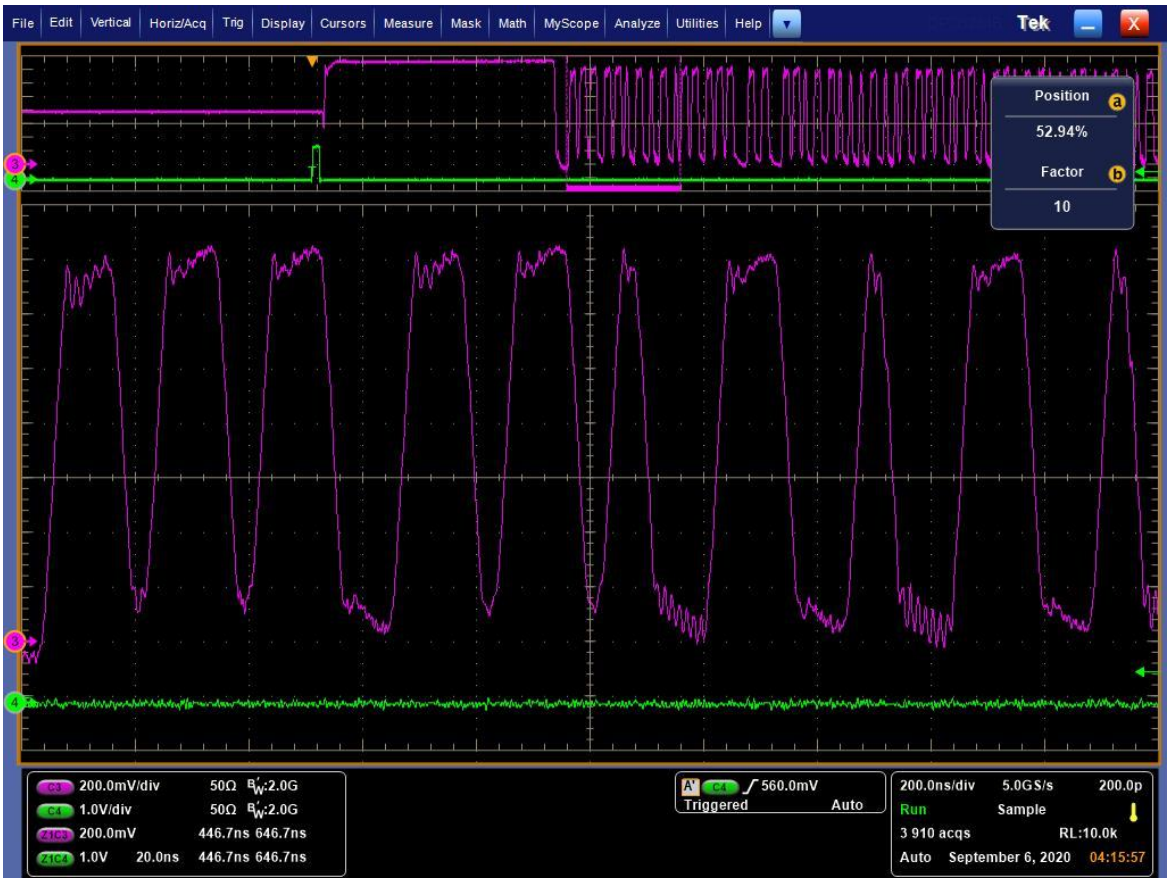
Added in Cf = 14pF (started at 6pF → 10pF and now 14pF / didn't take pix for 6pF & 10pF)



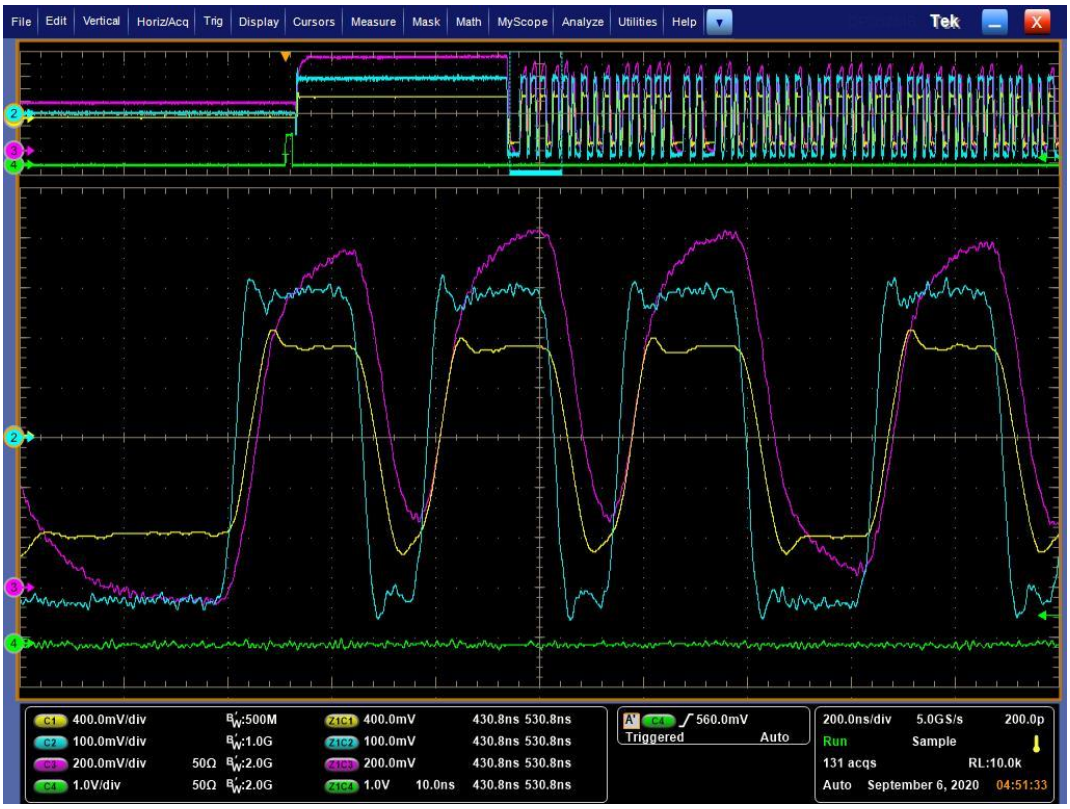



File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
52.94%
Factor
50
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 526.7ns 566.7ns
1.0V 4.0ns 526.7ns 566.7ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
3 313 acqs RL:10.0k
Auto September 6, 2020 04:15:27


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
52.94%
Factor
50
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 526.7ns 566.7ns
1.0V 4.0ns 526.7ns 566.7ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
3 416 acqs RL:10.0k
Auto September 6, 2020 04:15:32


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Position
52.94%
Factor
10
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 446.7ns 646.7ns
1.0V 20.0ns 446.7ns 646.7ns
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
3 910 acqs RL:10.0k
Auto September 6, 2020 04:15:57

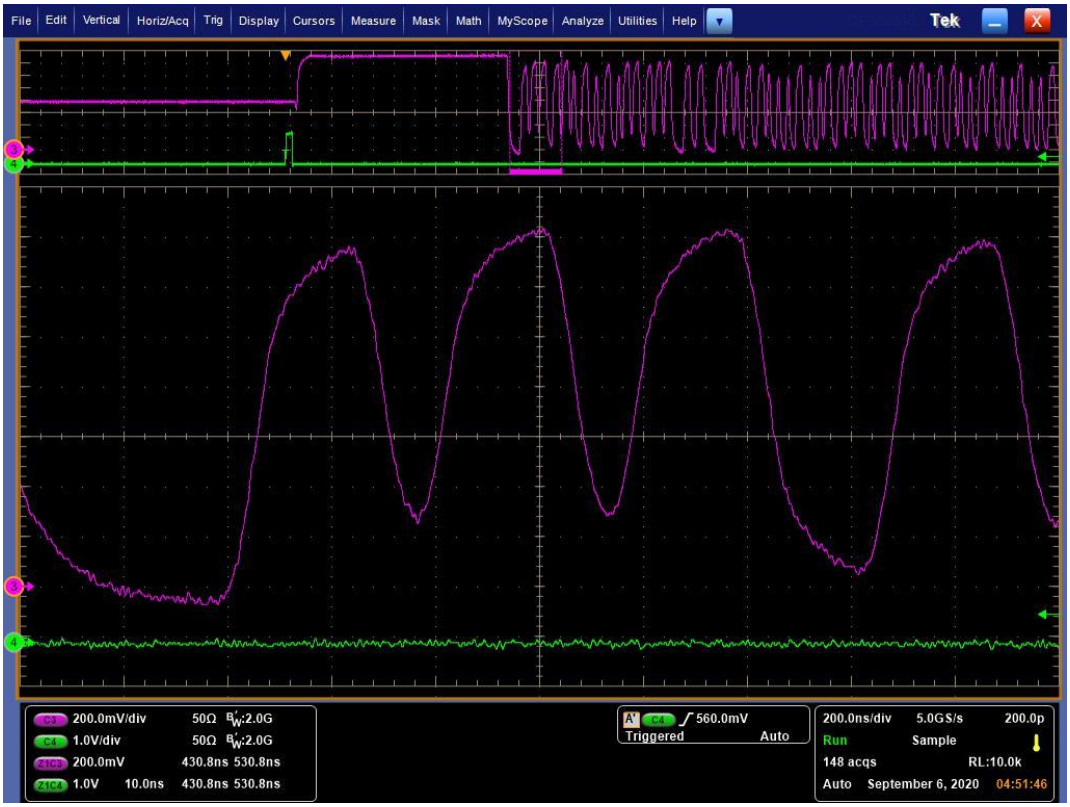
R11 changed to 845 ohms

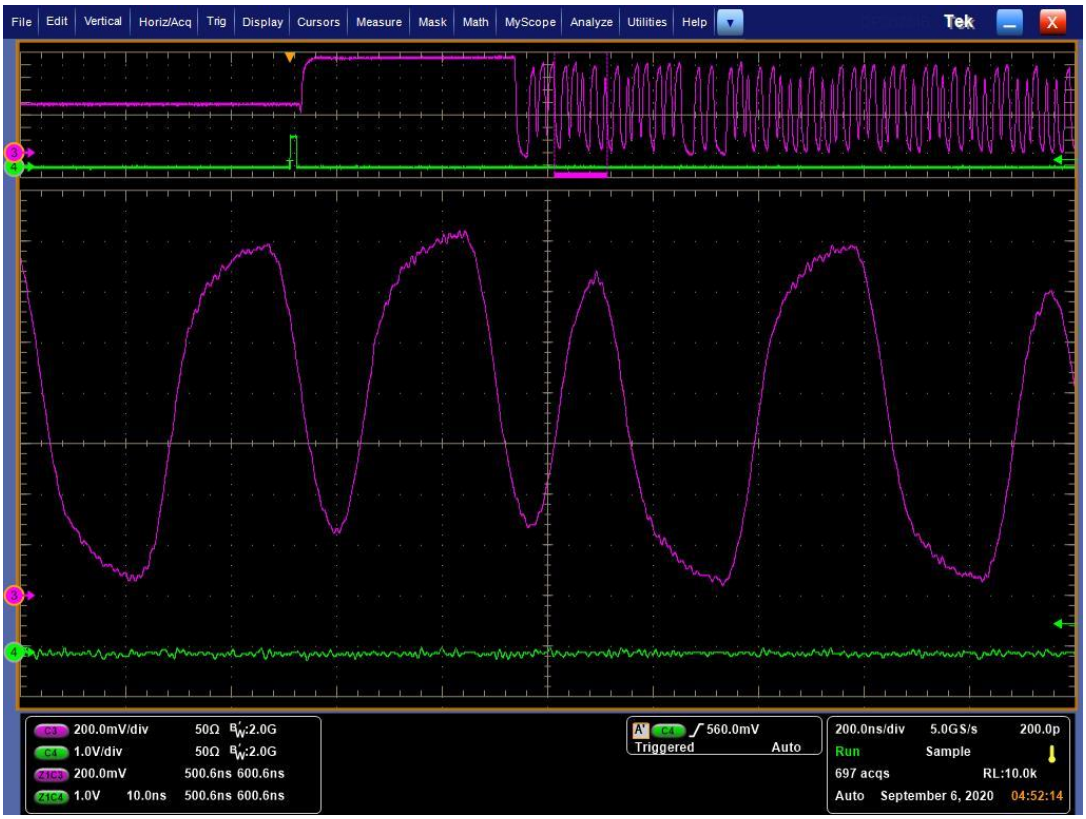


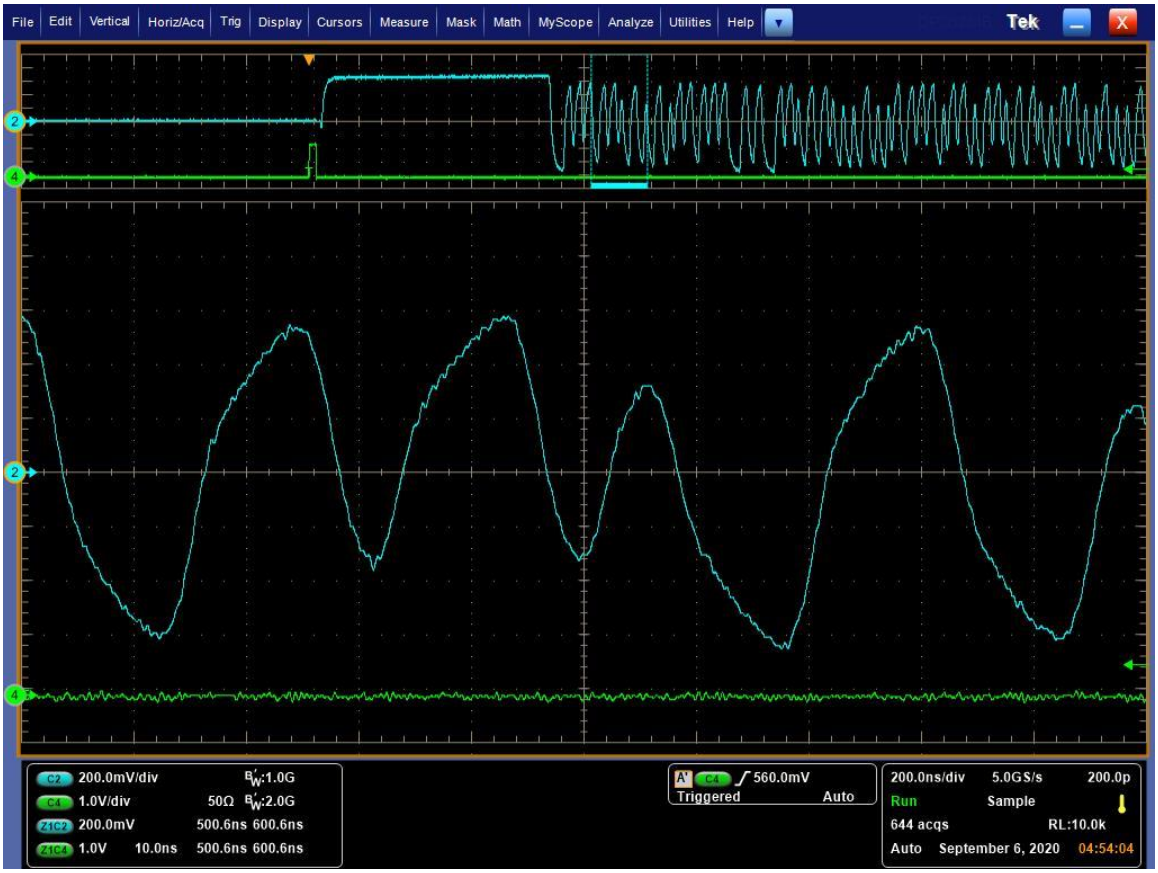
Trace 2: Input at TP1

Trace 1 (yel): U1 output at TP2 (after Riso)

Trace 3 (pur): J3 into scope Zin = 50 ohms







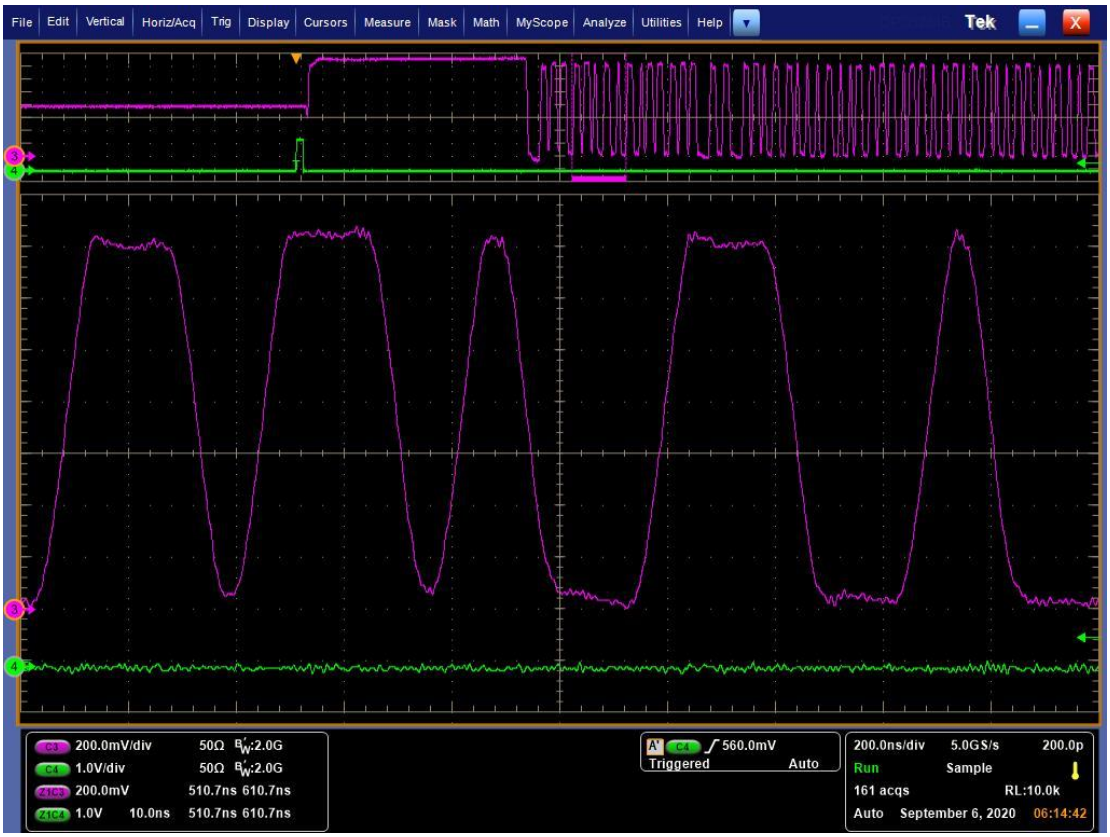
Trace 2: U4-3 showing the effect if R11 = 845 ohms

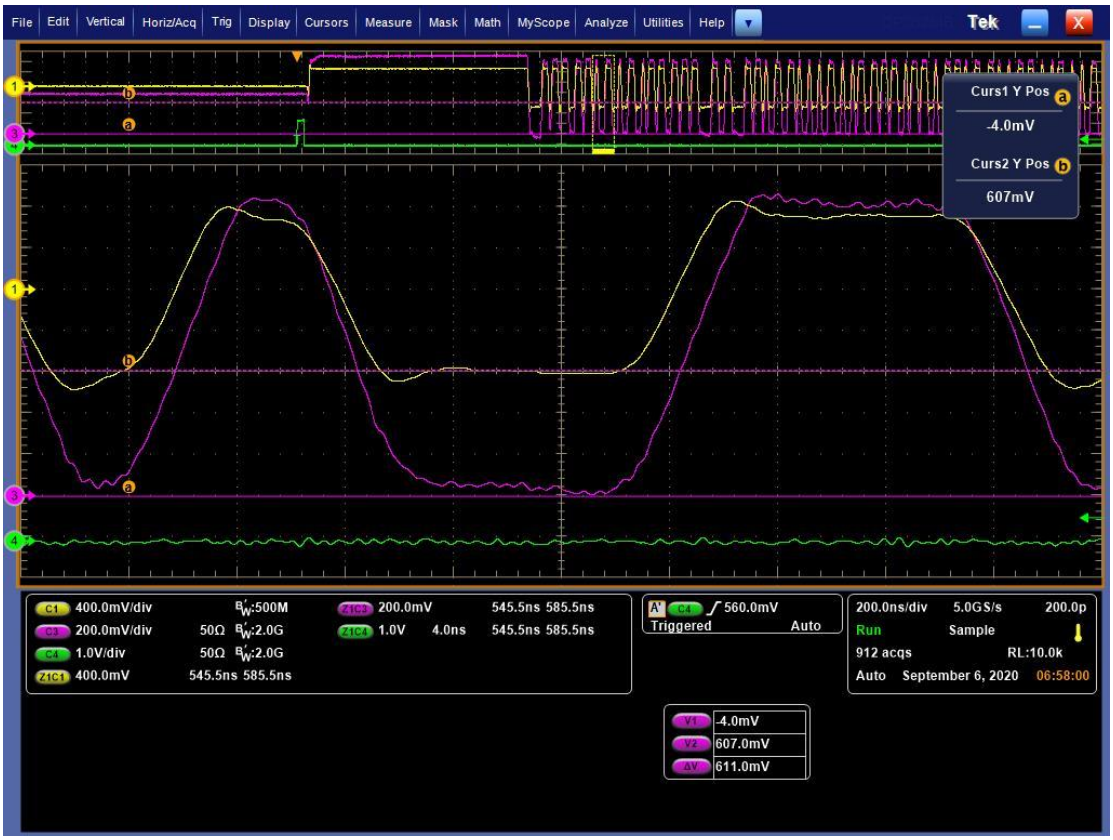
Cf = 8pF, R11 = 750 Ohms

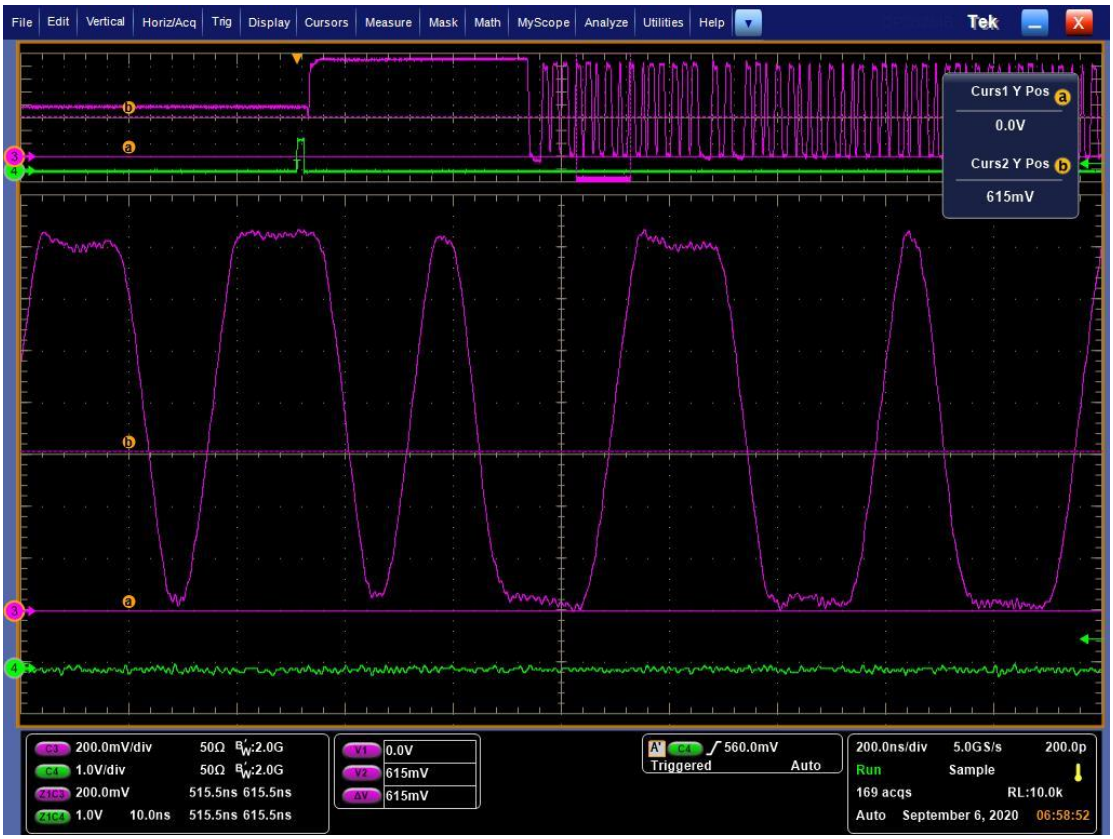
Trace 2: Input at TP1

Trace 1 (yel): U1 output at TP2 (after Riso)

Trace 3 (pur): J3 into scope Zin = 50 ohms

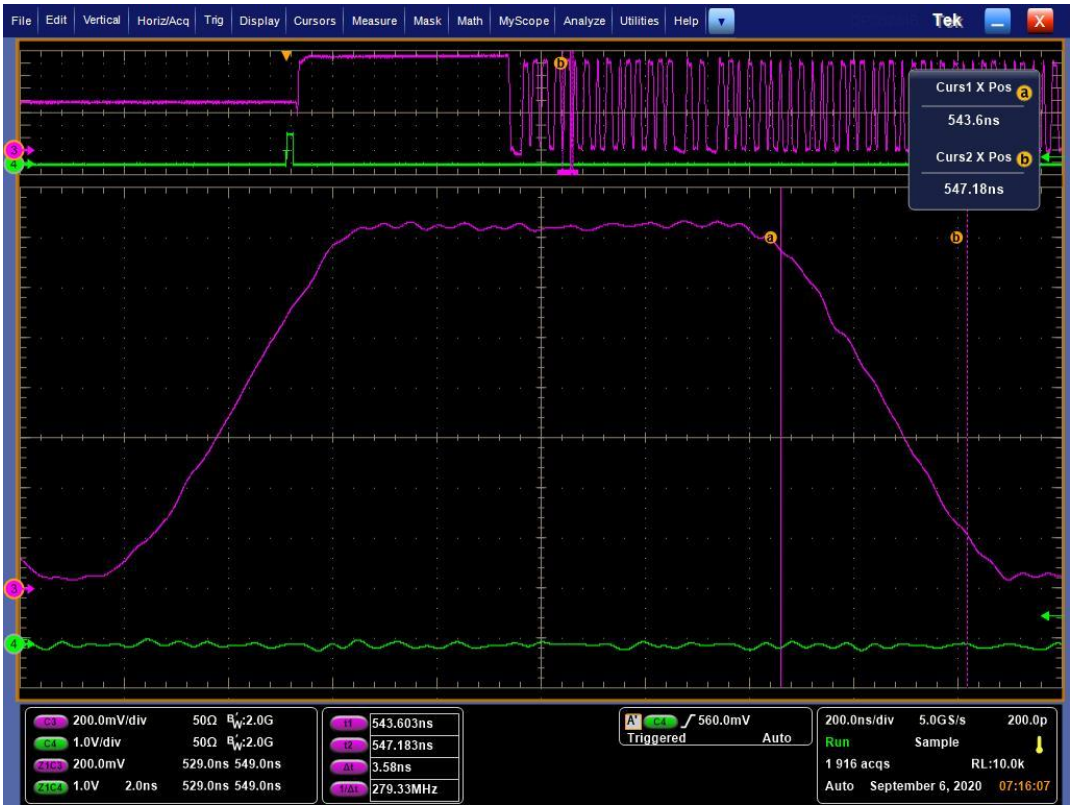

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C3 200.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 200.0mV 510.7ns 610.7ns
Z1C4 1.0V 10.0ns 510.7ns 610.7ns
A C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
161 acqs RL:10.0k
Auto September 6, 2020 06:14:42

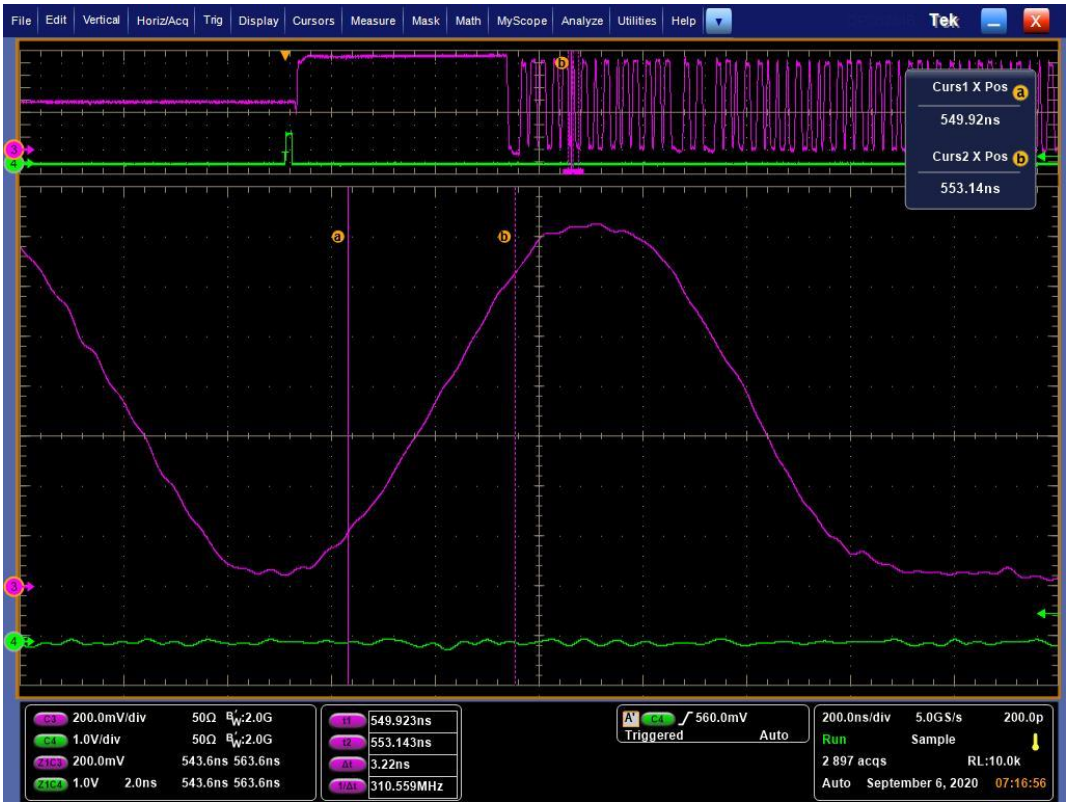

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos a
-4.0mV
Curs2 Y Pos b
607mV
C1 400.0mV/div BW:500M
C3 200.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C1 400.0mV 545.5ns 585.5ns
Z1C3 200.0mV 545.5ns 585.5ns
Z1C4 1.0V 4.0ns 545.5ns 585.5ns
A C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
912 acqs RL:10.0k
Auto September 6, 2020 06:58:00
V1 -4.0mV
V2 607.0mV
ΔV 611.0mV


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
0.0V
Curs2 Y Pos
615mV
C3 200.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 200.0mV 515.5ns 615.5ns
Z1C4 1.0V 10.0ns 515.5ns 615.5ns
V1 0.0V
V2 615mV
ΔV 615mV
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
169 acqs RL:10.0k
Auto September 6, 2020 06:58:52

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 Y Pos
0.0V
Curs2 Y Pos
61.75mV
C3 50.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 50.0mV 10.0ns 515.5ns 615.5ns
Z1C4 1.0V 10.0ns 515.5ns 615.5ns
V1 0.0V
V2 61.75mV
ΔV 61.75mV
A' C4 560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
563 acqs RL:10.0k
Auto September 6, 2020 06:59:25

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
531.38ns
Curs2 X Pos
534.84ns
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 529.0ns 549.0ns
1.0V 2.0ns 529.0ns 549.0ns
t1 531.383ns
t2 534.843ns
Δt 3.46ns
1/Δt 289.017MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 204 acqs RL:10.0k
Auto September 6, 2020 07:15:31


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
543.6ns
Curs2 X Pos
547.18ns
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 529.0ns 549.0ns
1.0V 2.0ns 529.0ns 549.0ns
t1 543.603ns
t2 547.183ns
Δt 3.58ns
1/Δt 279.33MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
1 916 acqs RL:10.0k
Auto September 6, 2020 07:16:07

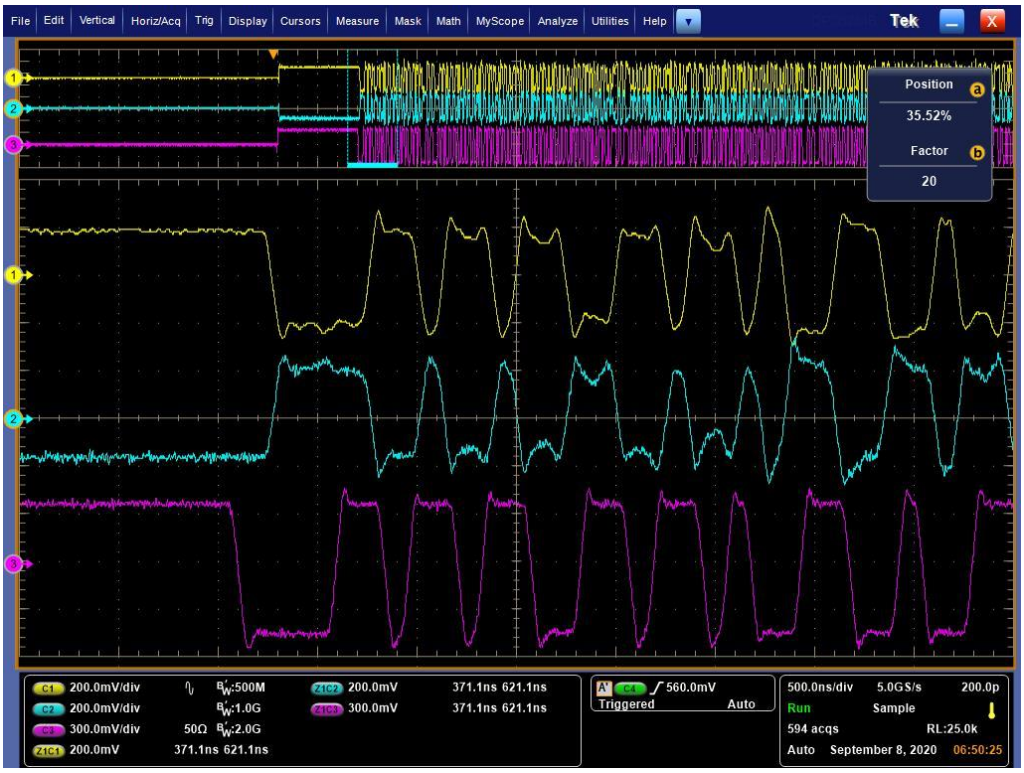

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
549.92ns
Curs2 X Pos
553.14ns
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 543.6ns 563.6ns
1.0V 2.0ns 543.6ns 563.6ns
t1 549.923ns
t2 553.143ns
Δt 3.22ns
1/Δt 310.559MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
2 897 acqs RL:10.0k
Auto September 6, 2020 07:16:56

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
556.06ns
Curs2 X Pos
559.52ns
200.0mV/div 50Ω BW:2.0G
1.0V/div 50Ω BW:2.0G
200.0mV 543.6ns 563.6ns
1.0V 2.0ns 543.6ns 563.6ns
t1 556.063ns
t2 559.523ns
Δt 3.46ns
1/Δt 289.017MHz
560.0mV
Triggered Auto
200.0ns/div 5.0GS/s 200.0p
Run Sample
3 365 acqs RL:10.0k
Auto September 6, 2020 07:17:19

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
513.1ns
Curs2 X Pos
515.74ns
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 2.0ns
50Ω
510.4ns 530.4ns
t1 513.103ns
t2 515.743ns
Δt 2.64ns
1/Δt 378.788MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
1 098 acqs
RL:10.0k
Auto September 6, 2020 07:19:03
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
525.26ns
Curs2 X Pos
528.02ns
C1 300.0mV/div
C4 1.0V/div
Z1C1 300.0mV
Z1C4 1.0V 2.0ns
50Ω
510.4ns 530.4ns
t1 525.263ns
t2 528.023ns
Δt 2.76ns
1/Δt 362.319MHz
560.0mV
Triggered
Auto
200.0ns/div
5.0GS/s
200.0p
Run
Sample
1 729 acqs
RL:10.0k
Auto September 6, 2020 07:19:34
Cursor Controls
Source
Cursor 1
Cursor 2
Ch 1
Cursor Type
H Bars
V Bars
Waveform
Screen
Move Cursors to Center
Setup

Differential Output

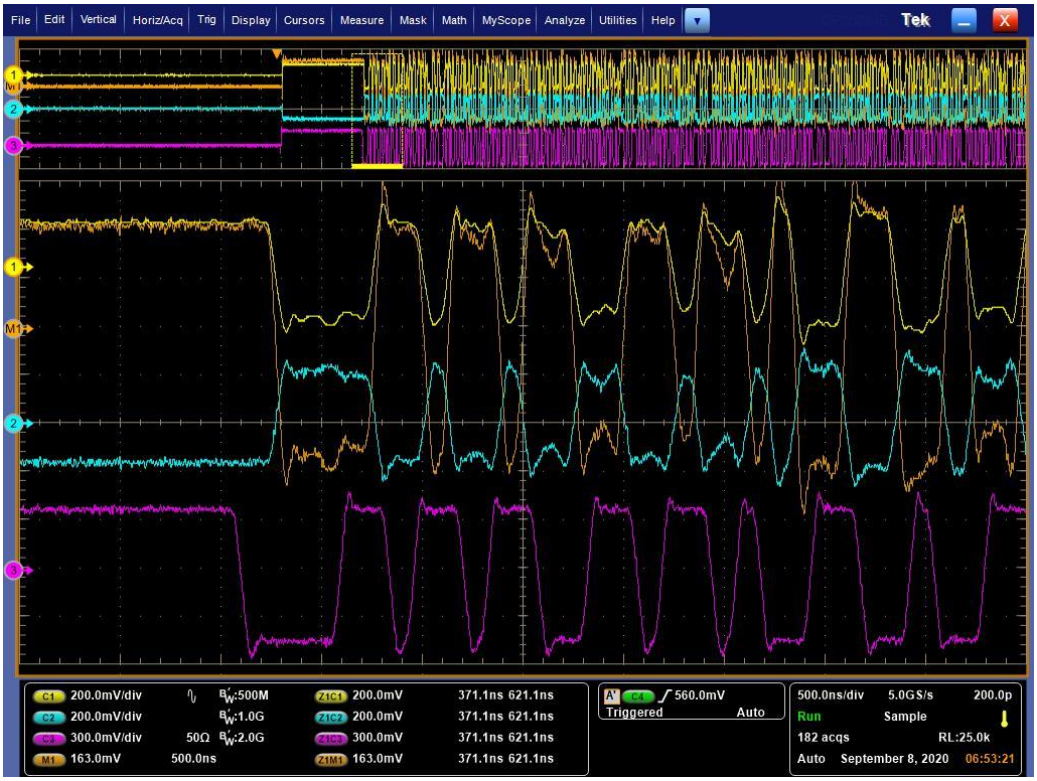


Trace 3 (pur): Monitor output

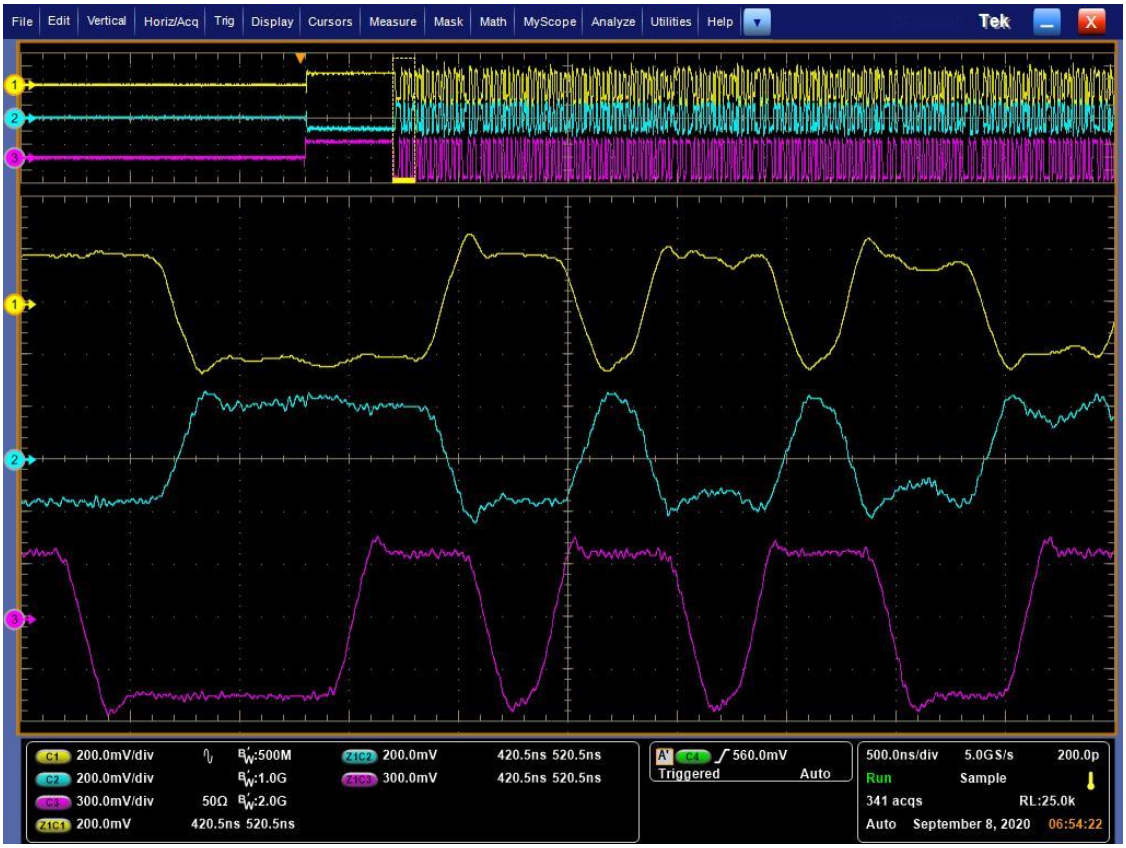
Trace 1 (yel): Diff_out_p

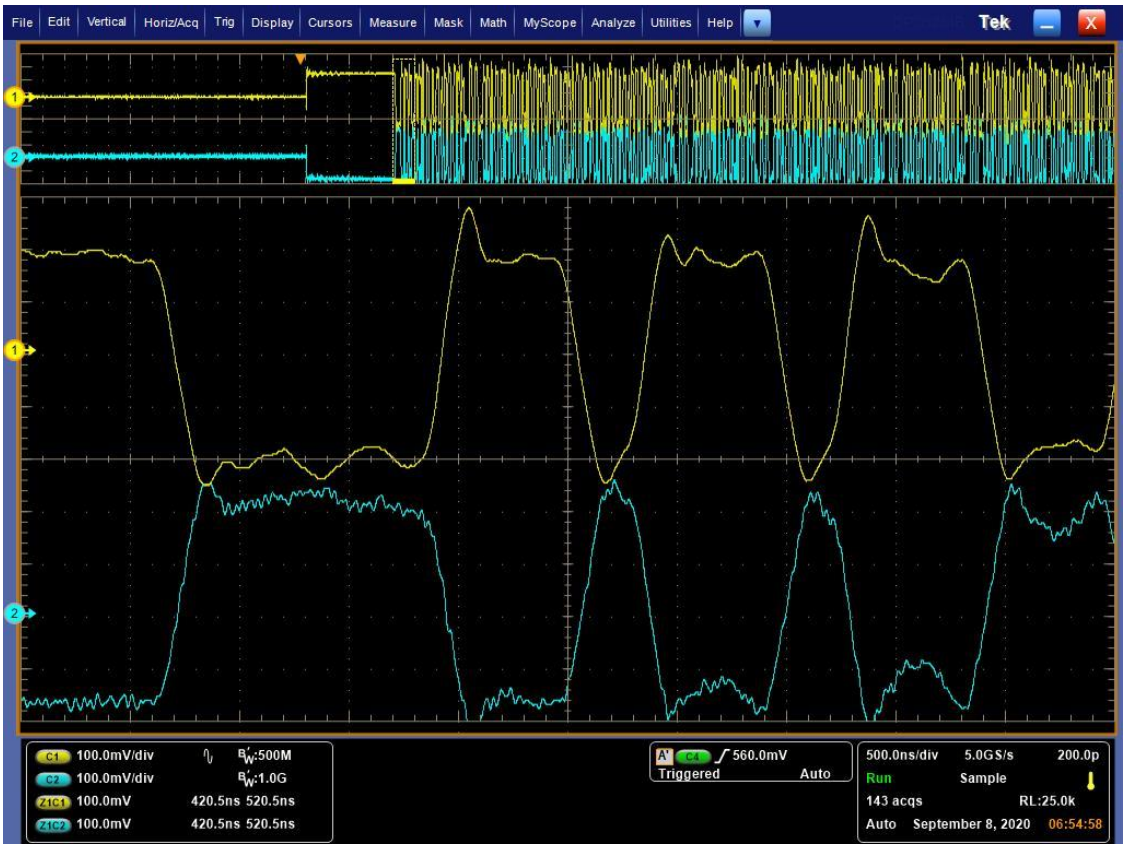
Trace 2 (blu): Diff_out_p

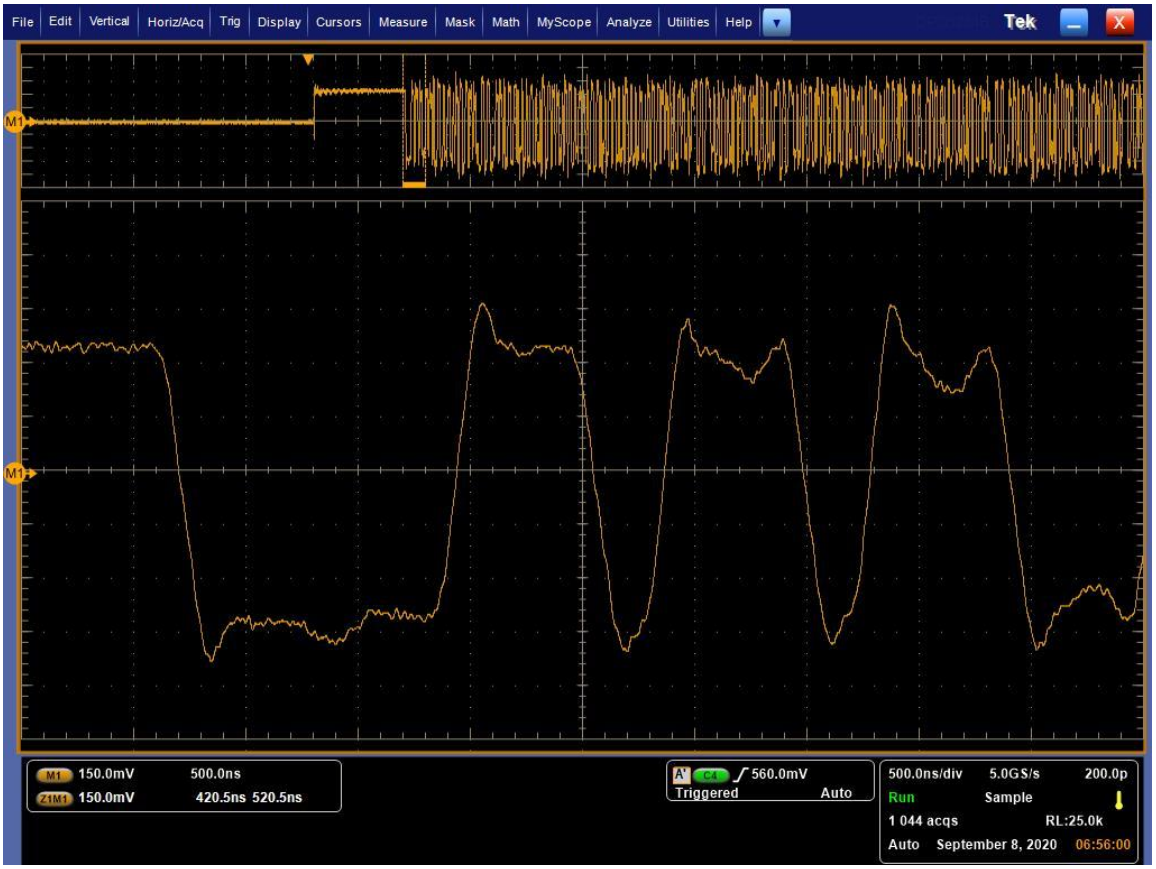
Diff'l signals measured at end of 3 ft cable at 100 ohm ¼ Watt Rterm / Gnds are not optimal



M1 = Trace1 – Trace2


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 200.0mV/div
C2 200.0mV/div
C3 300.0mV/div 50Ω
Z1C1 200.0mV 420.5ns 520.5ns
BW:500M
BW:1.0G
BW:2.0G
Z1C2 200.0mV 420.5ns 520.5ns
Z1C3 300.0mV 420.5ns 520.5ns
A C4 560.0mV
Triggered Auto
500.0ns/div 5.0GS/s 200.0p
Run Sample
341 acqs RL:25.0k
Auto September 8, 2020 06:54:22


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C1 100.0mV/div
C2 100.0mV/div
Z1C1 100.0mV 420.5ns 520.5ns
Z1C2 100.0mV 420.5ns 520.5ns
BW:500M
BW:1.0G
A C4 560.0mV
Triggered Auto
500.0ns/div 5.0GS/s 200.0p
Run Sample
143 acqs RL:25.0k
Auto September 8, 2020 06:54:58


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
M1
M1
M1 150.0mV 500.0ns
ZM1 150.0mV 420.5ns 520.5ns
A C4 560.0mV
Triggered Auto
500.0ns/div 5.0GS/s 200.0p
Run Sample
1 044 acqs RL:25.0k
Auto September 8, 2020 06:56:00

Major Design Change:
Changed AWG to output single-ended only & experimented with input signal level vs slew rate to find optimal signal input vs output level.
Preamp: Av=+3, R2=124, R3=249, R1000=30
SE Amp: Cut trace just after TP4 & wired it to Gnd to remove & isolate the Voffset generator (in new build this circuit would not be populated & R9 would be installed instead). R11 = 10, R10=124, R12=249, U4=THS4271 (Av=+3).
Diff Amp: Unchanged

(all changes recorded in DA design changes document – see project wiki)

Trace 3 (pur): J3 SE output

Trace 1 (yel): preamp out TP2

Trace 2 (blu): AWG input TP1

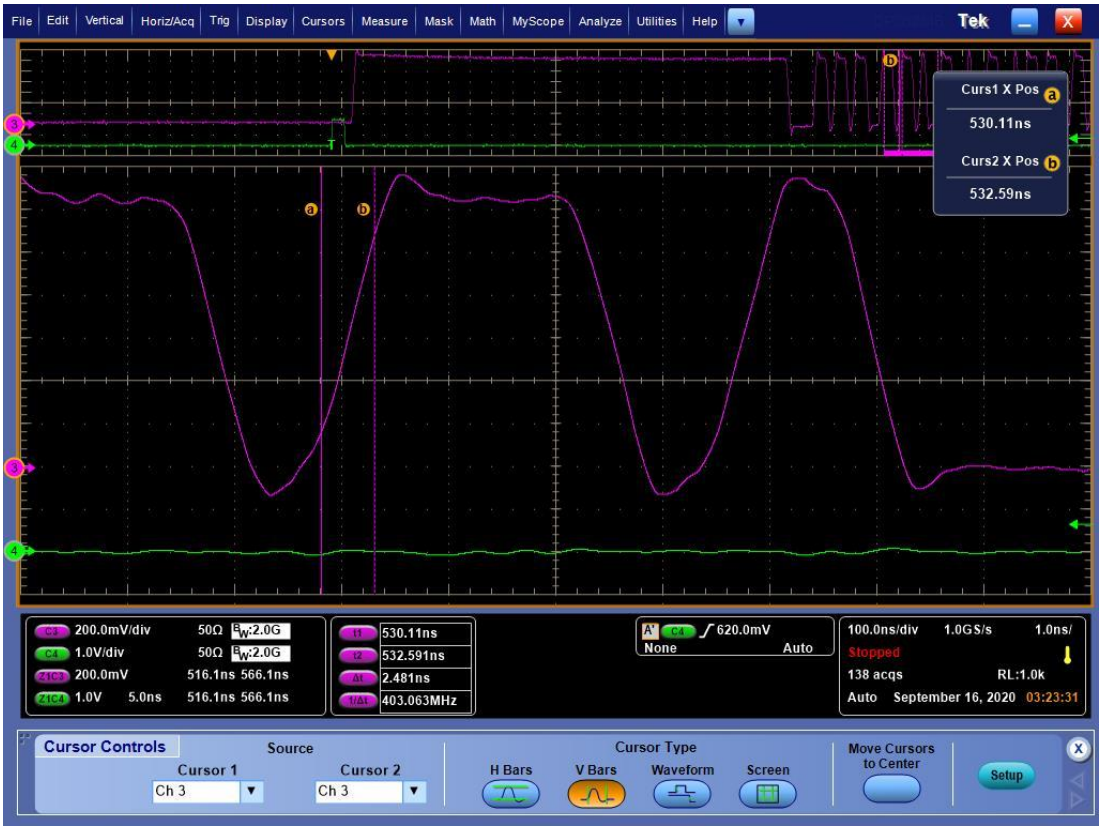
Trace 4 (Grn): Marker out from AWG, scope trigger

Trace 2 (blu): AWG output at TP1 (input to DA)

Trace 1 (yel): Preamp output (TP2)

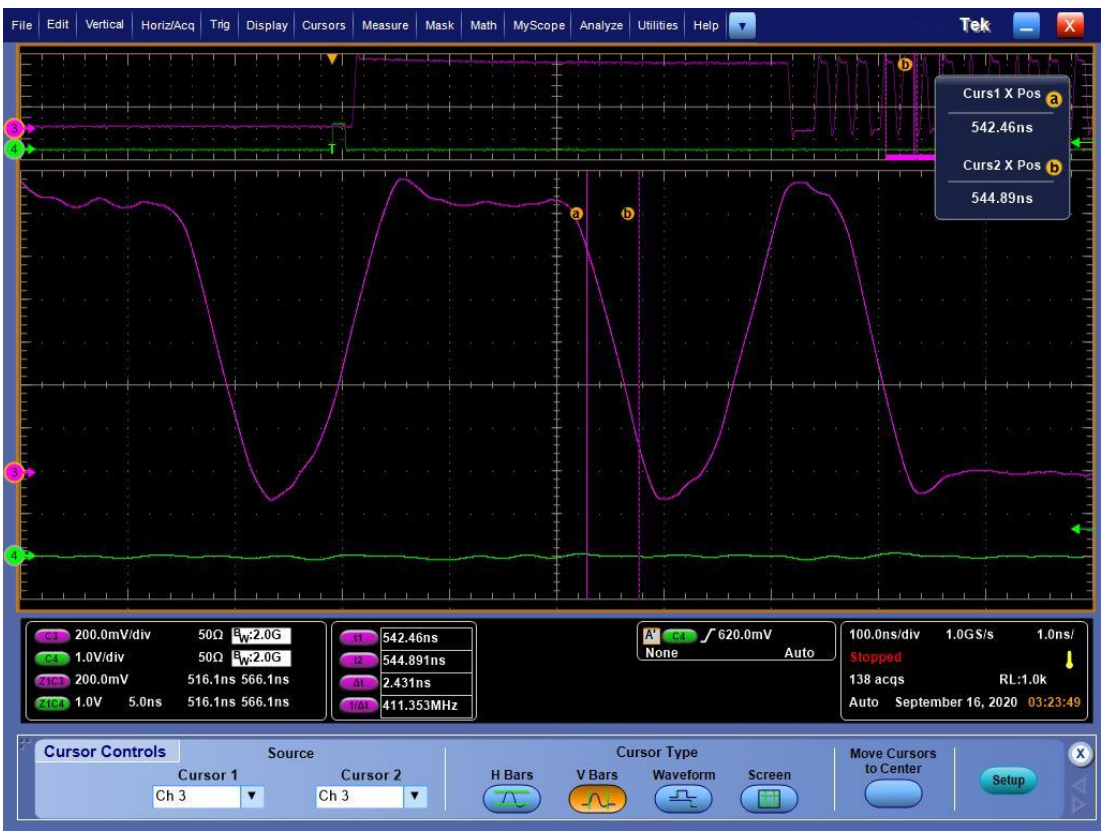
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
C3 300.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 300.0mV 509.8ns 609.8ns
Z1C4 1.0V 10.0ns 509.8ns 609.8ns
V1 960mV
V2 7.215V
ΔV 6.255V
A C4 620.0mV
Triggered Auto
100.0ns/div 1.0GS/s 1.0ns/
Run Sample
166 acqs RL:1.0k
Auto September 16, 2020 03:22:22

J3 output



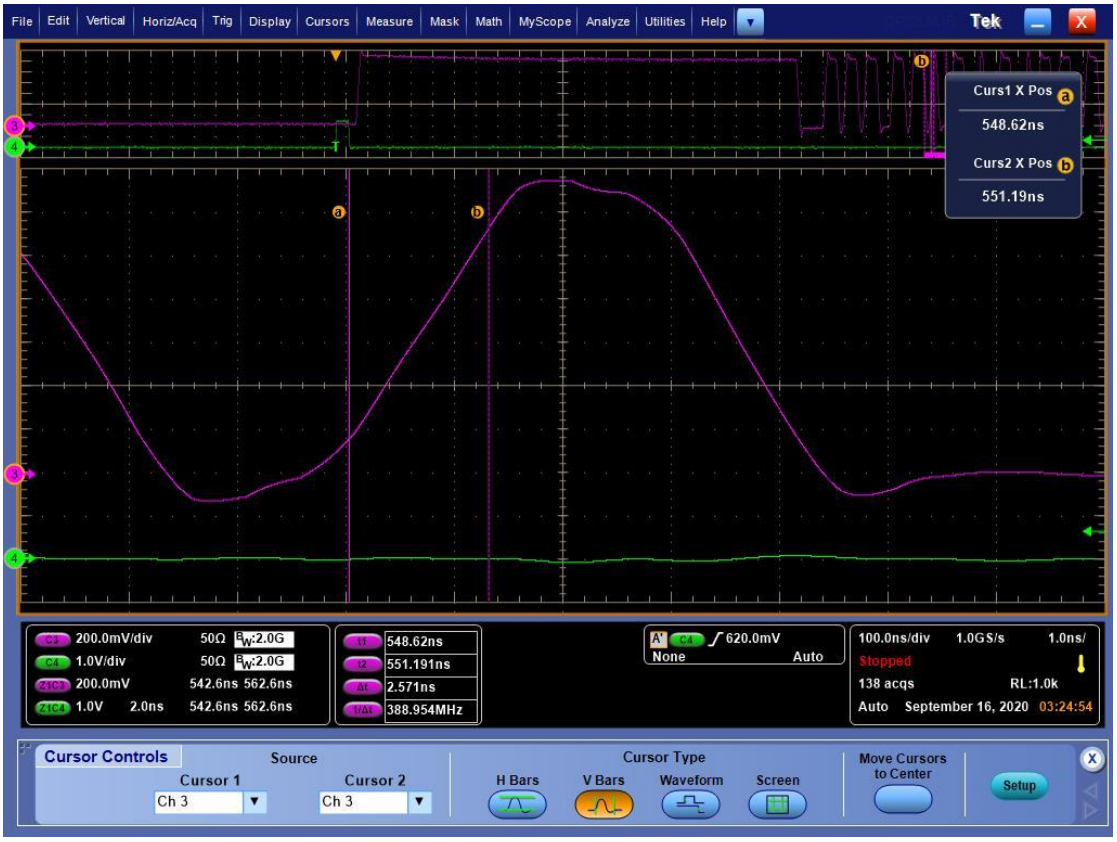
J3 output

long pulse
Risetime



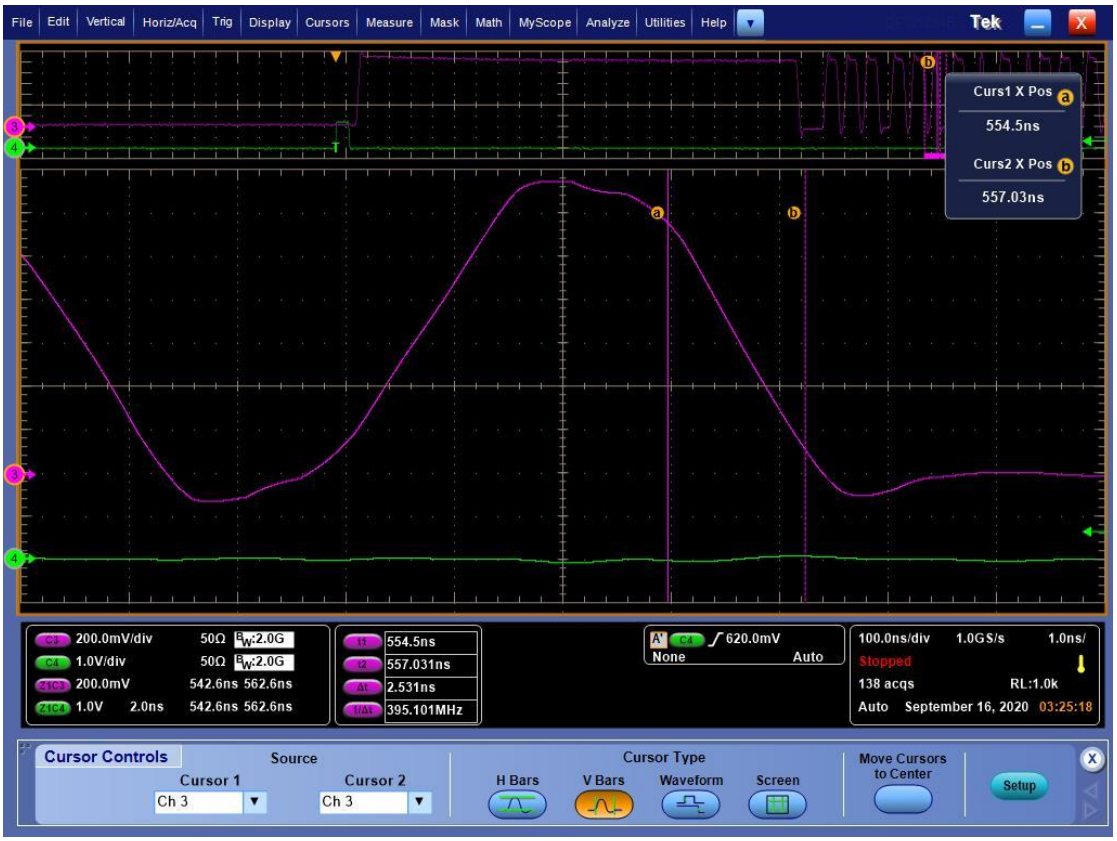
J3 output

long pulse
Falltime



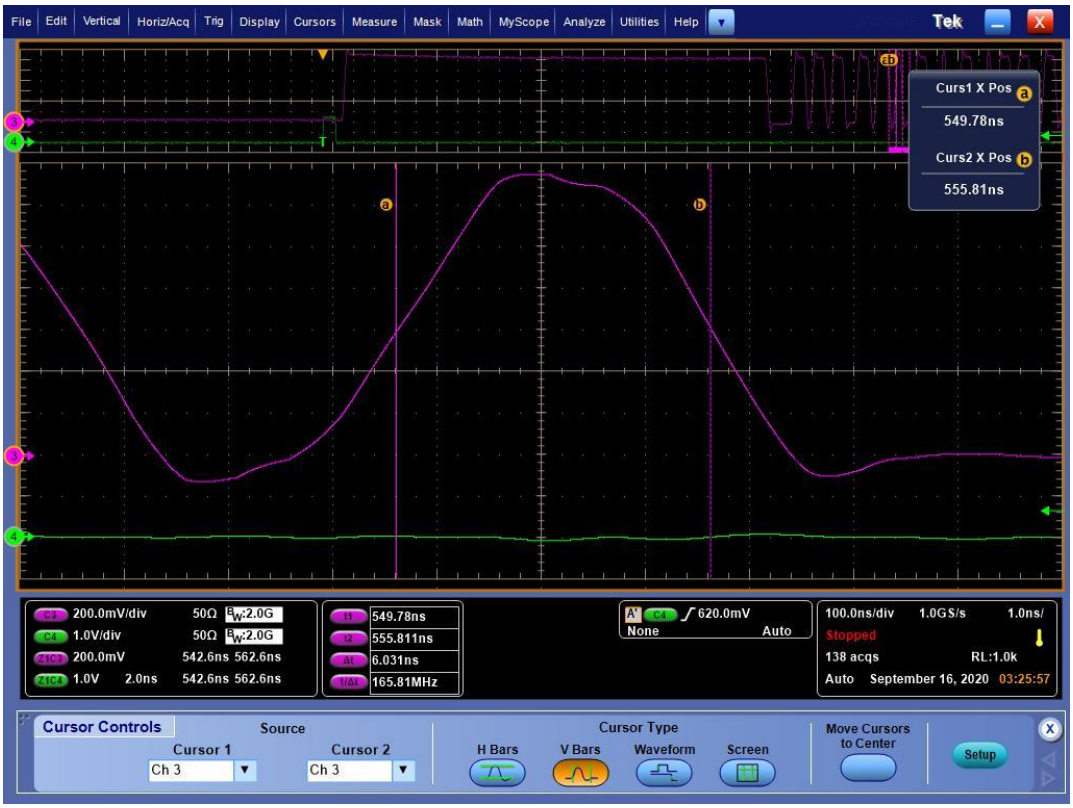
J3 output

Short pulse
Risetime



J3 output

Short pulse
Falltime



J3 output, measuring width at 600mV (rx threshold level)

6.031ns

Trace 3: J2 Monitor signal output into scope at Z0=50 ohms

Differential output:

RJ-45 Test cable connected, with 100 ohm Rterm on Grn/Wht-Grn wired.

Trace 1 (yel): Diff_Amp_Out_p (tp6)

Trace 2 (blu): Diff_Amp_Out_pn(tp7)

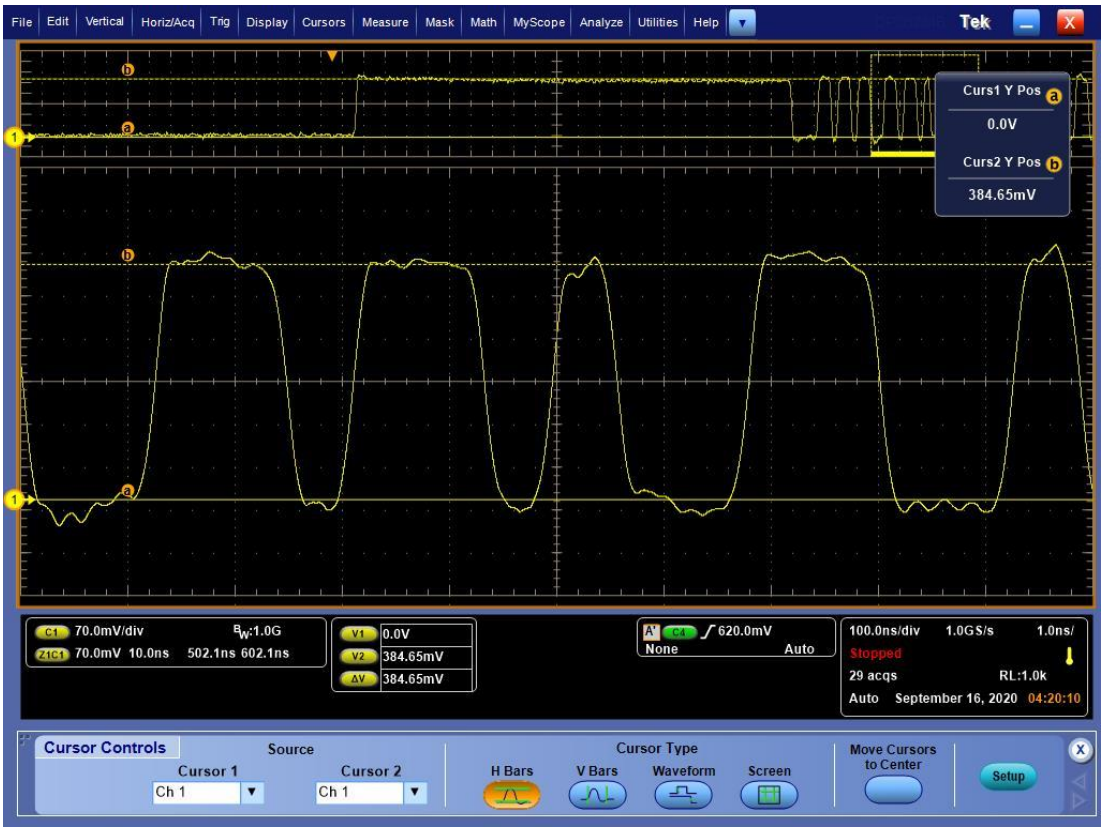
Waveform Math (Ch1-Ch2)

Waveform Math (Ch1-Ch2)

Short pulse risetime

Waveform Math (Ch1-Ch2)

Short pulse Falltime



Ch1: DA R22, R23, R24 junction node: input to diff'f amp

Note amplitude: less than expected due to new 30 ohm series resistor at output of preamp.

Re-calculated the signal levels taking in to account the resistive divider effect and now the levels make sense and agree with the calculated values.

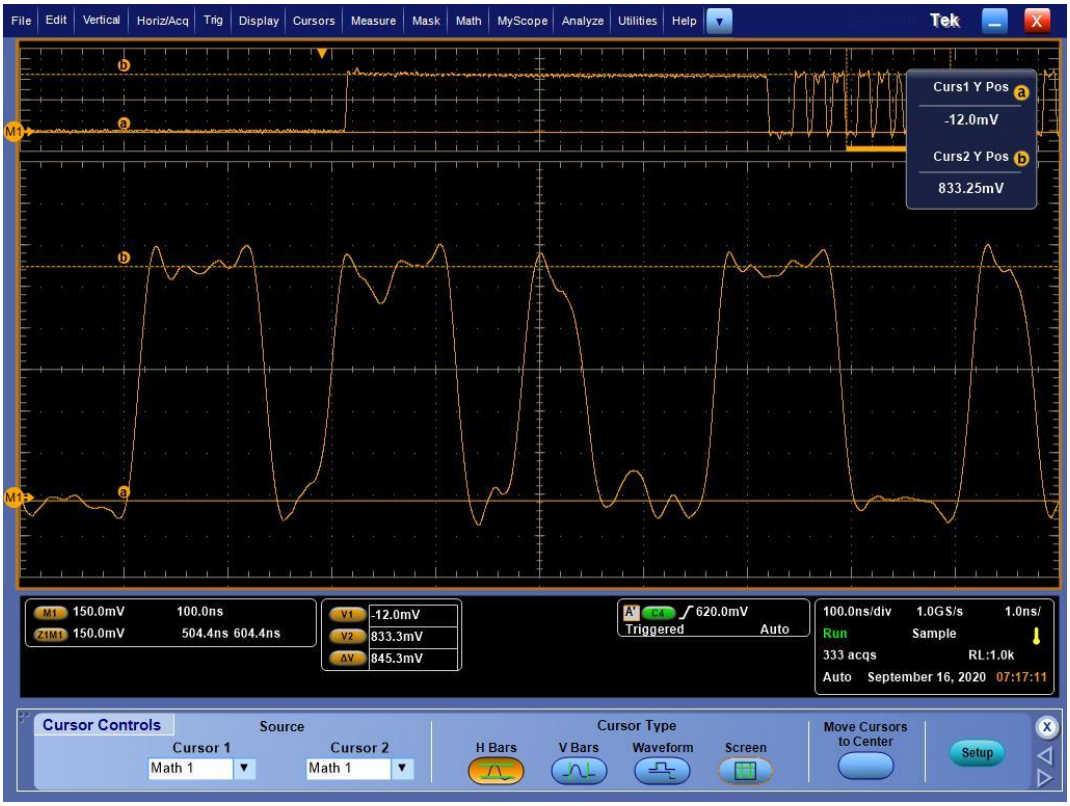
Changed Gain of differential output driver amp to Av = +4 (R17 & R24 changed to 62 ohms)

Differential output:

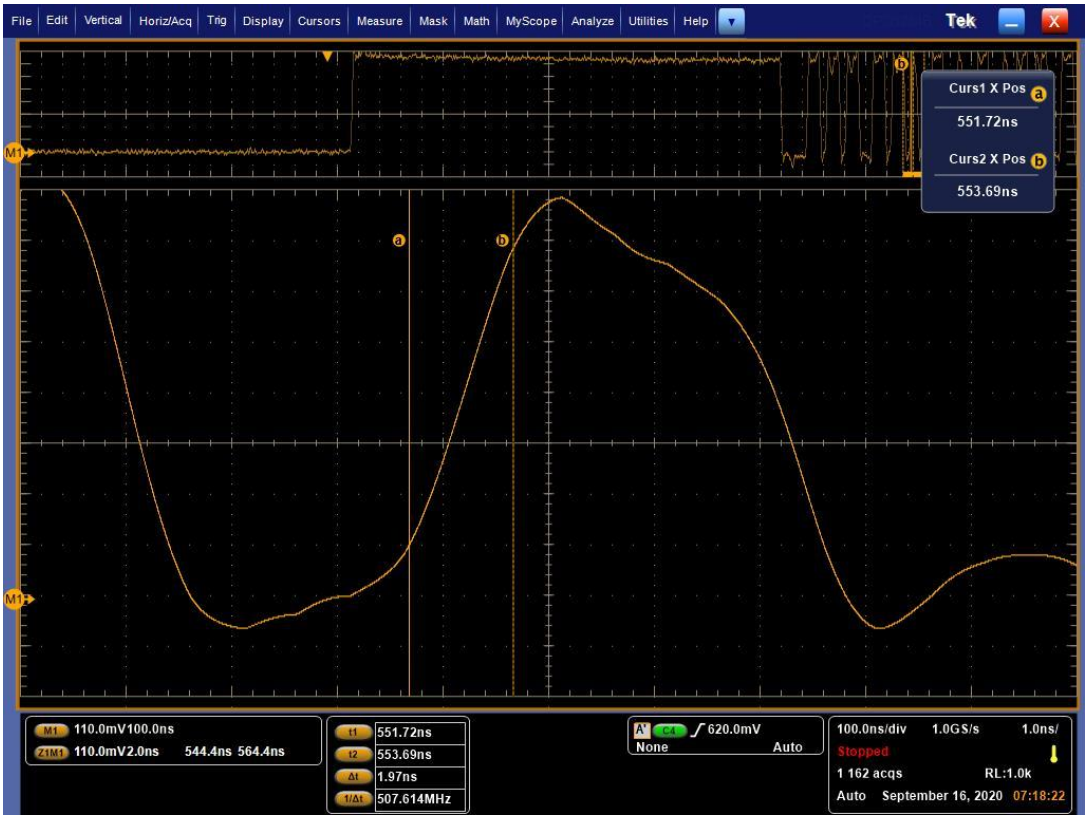
RJ-45 Test cable connected, with 100 ohm Rterm on Grn/Wht-Grn wired.

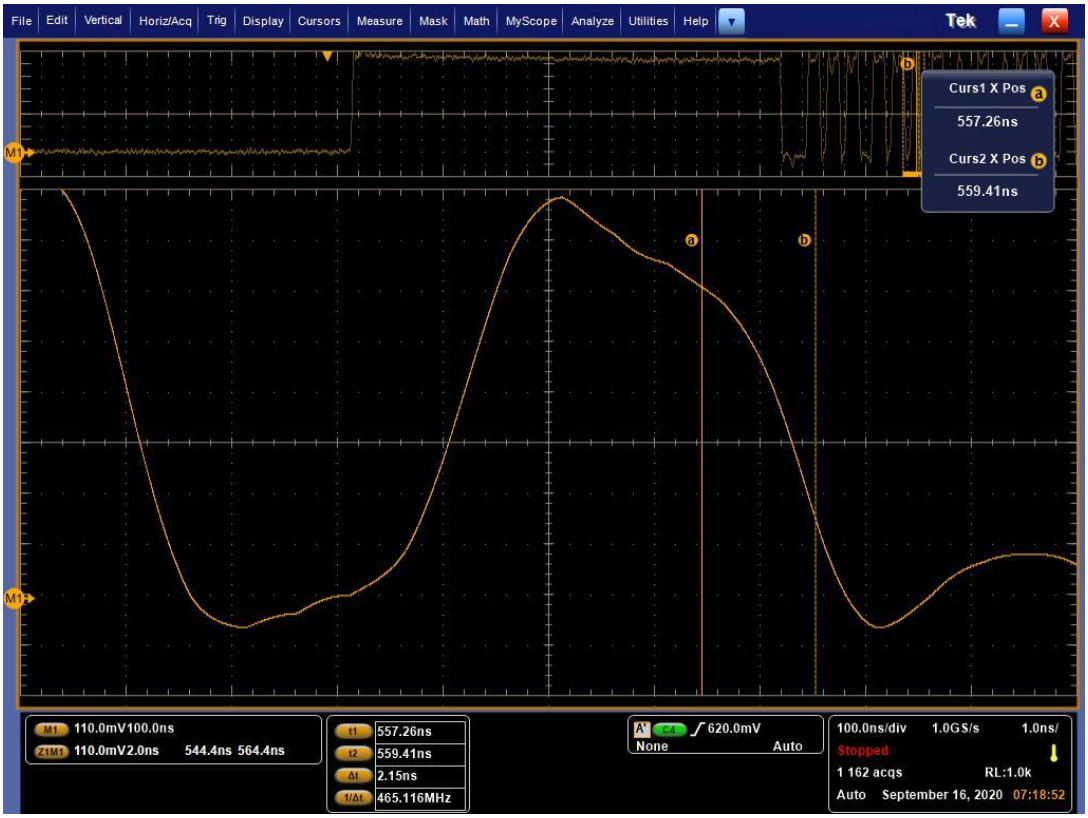
Trace 1 (yel): Diff_Amp_Out_p (tp6)

Trace 2 (blu): Diff_Amp_Out_pn(tp7)

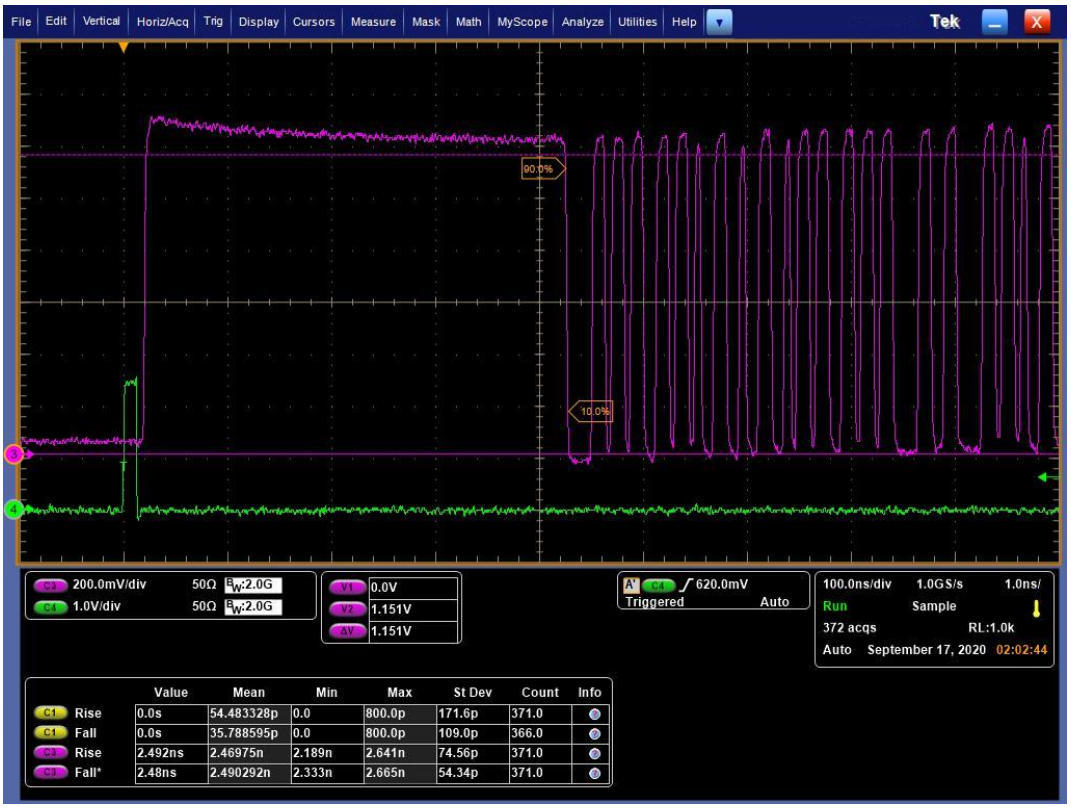


Waveform Math (Ch1-Ch2)


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
551.72ns
Curs2 X Pos
553.69ns
M1 110.0mV100.0ns
Z1M1 110.0mV2.0ns 544.4ns 564.4ns
t1 551.72ns
t2 553.69ns
Δt 1.97ns
1/Δt 507.614MHz
620.0mV
None Auto
100.0ns/div 1.0GS/s 1.0ns/
Stopped
1 162 acqs RL:1.0k
Auto September 16, 2020 07:18:22


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Curs1 X Pos
557.26ns
Curs2 X Pos
559.41ns
M1 110.0mV100.0ns
Z1M1 110.0mV2.0ns 544.4ns 564.4ns
t1 557.26ns
t2 559.41ns
Δt 2.15ns
1/Δt 465.116MHz
620.0mV
None Auto
100.0ns/div 1.0GS/s 1.0ns/
Stopped
1 162 acqs RL:1.0k
Auto September 16, 2020 07:18:52

Changed U4 to EL5166 / R12 = 750 ohms / R10 = 374 ohms



File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
90.0%
10.0%
Curs1 X Pos
548.4ns
Curs2 X Pos
550.4ns
C3 200.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 200.0mV 542.7ns 562.7ns
Z1C4 1.0V 2.0ns 542.7ns 562.7ns
t1 548.4ns
t2 550.4ns
Δt 2.0ns
1/Δt 500MHz
A' C4 620.0mV
None Auto
100.0ns/div 1.0GS/s 1.0ns/
Stopped
6 373 acqs RL:1.0k
Auto September 17, 2020 02:08:11
Value Mean Min Max St Dev Count Info
C1 Rise 0.0s 94.601161p 0.0 1.6n 237.0p 6.373k
C1 Fall 0.0s 60.750431p 0.0 1.6n 179.3p 6.269k
C3 Rise 2.491ns 2.4878438n 2.107n 2.692n 57.98p 6.373k
C3 Fall* 2.453ns 2.4867759n 2.23n 2.719n 59.72p 6.373k

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
90.0%
10.0%
Curs1 X Pos
554.54ns
Curs2 X Pos
556.86ns
C3 200.0mV/div 50Ω BW:2.0G
C4 1.0V/div 50Ω BW:2.0G
Z1C3 200.0mV 542.7ns 562.7ns
Z1C4 1.0V 2.0ns 542.7ns 562.7ns
t1 554.54ns
t2 556.86ns
Δt 2.32ns
1/Δt 431.034MHz
A' C4 620.0mV
None Auto
100.0ns/div 1.0GS/s 1.0ns/
Preview
0 acqs RL:1.0k
Auto September 17, 2020 02:08:41
Value Mean Min Max St Dev Count Info
C1 Rise 0.0s 0.0 0.0 0.0 0.0 1.0
C1 Fall 0.0s 0.0 0.0 0.0 0.0 1.0
C3 Rise 2.491ns 2.4913635n 2.491n 2.491n 0.0 1.0
C3 Fall* 2.453ns 2.4526349n 2.453n 2.453n 0.0 1.0

Ch3 (pur): J3 SE output into scope (Zterm = 50 ohms) via 5ns RG-58 cable

Smallest pulse: width = 6.32ns (measured at 600mV rx threshold point (Ideal value = 6.1538ns)

➔ **Conclusion**:

At this point, the single-ended output looks quite good, the EL5166 is a better behaved device. The choice of Rf = 750 ohms (above the normal 249 ohms) helps to roll off the frequency response. It may be possible to get better time-domain performance with smaller feedback resistor values, trading off possible ringing at the pulse edges. But this is probably good enough, at least for now. If higher performance is required, this can be revisited later.