Design Note:

HFDN-12.0

Rev 0; 03/01

MAX3752 Impedance-Matching Experiments

MAXIM High-Frequency/Fiber Communications Group

Maxim Integrated Products

MAX3752 Impedance-Matching Experiments

1 Overview

The MAX3752 quad port bypass circuit can be cascaded with other MAX3752s. The purpose of this design note is to present the results of experiments that were performed in an effort to determine the relative merits of various impedance-matching and line-termination configurations.

The inputs and outputs of the MAX3752 are internally terminated to 75Ω. Connecting to other 75Ω devices via 75Ω transmission lines is straightforward. In many instances, however, it is necessary to connect with 50Ω lines or devices.

The following experiments were performed with the MAX3752 in order to study the effects of different types of connections, using 75Ω and 50Ω transmission lines. These experiments were performed using a modified MAX3752 EV kit with a 2^7-1 PRBS test pattern at 2.125 Gbps for the input data. A single-ended HP83480A oscilloscope was connected to one output (the unused MAX3752 output was terminated to 50Ω). The CDR on the MAX3752 was disabled. Total jitter was measured using the horizontal histogram mode on the oscilloscope.

The experiments and the associated data are summarized in Table 1.

Table 1. Data Summary

Section Link	Experiment Number and Description	Jitter (ps RMS)	Jitter (ps p-p)
3.1	1. Baseline Configuration A	3.4	22.2
3.2	2. Baseline Configuration B	11.1	44.4
3.3	3. 50Ω Transmission Line, Standard EV Kit Termination at Driver, 300Ω Termination at Load	6.1	31.1
3.4	4. 50Ω Transmission Line, No Terminations	9.8	48.9
3.5	5. 50Ω Transmission Line, No Termination at Driver, 300Ω Termination at Load	6.9	35.6
3.6	6. 50Ω Transmission Line, 300Ω Termination at Driver, 300Ω Termination at Load	7.0	35.6
3.7	7. 50Ω Transmission Line, 300Ω Termination at Driver, No Termination at Load	6.6	35.6
3.8	8. 75Ω Transmission Lines, No Terminations (chip is internally terminated to 75Ω)	9.0	44.4

2 Notes

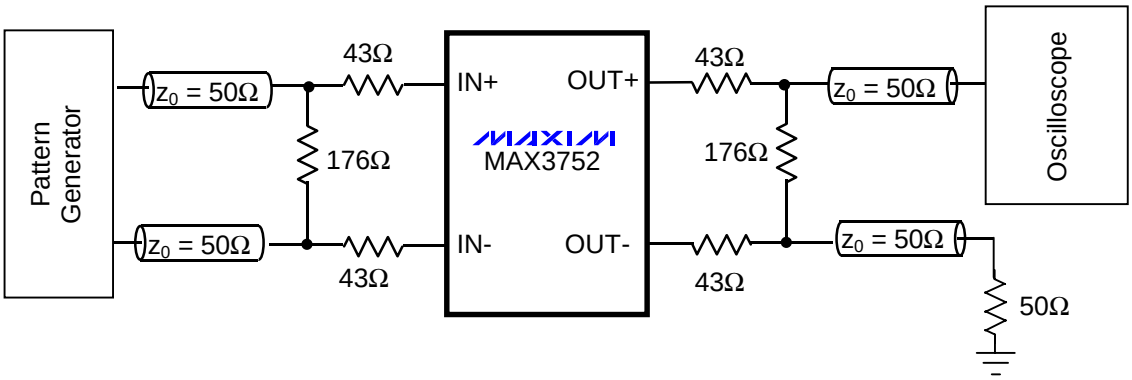
1. Experiments 3 through 8 are comparable directly, as everything but the terminations was the same (cables, connection method, etc.).

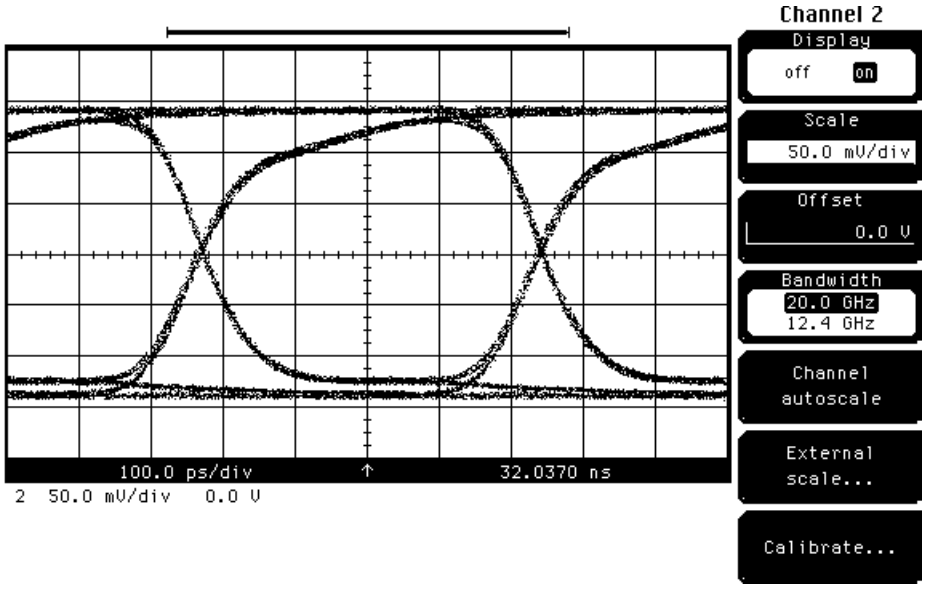
2. Experiments 1, 2, and 8 cannot be compared directly to any other experiments, because they used different cables in each case.

3 Experiments

3.1 Experiment 1. Baseline Configuration A

(Unmodified EV kit, all ports bypassed)





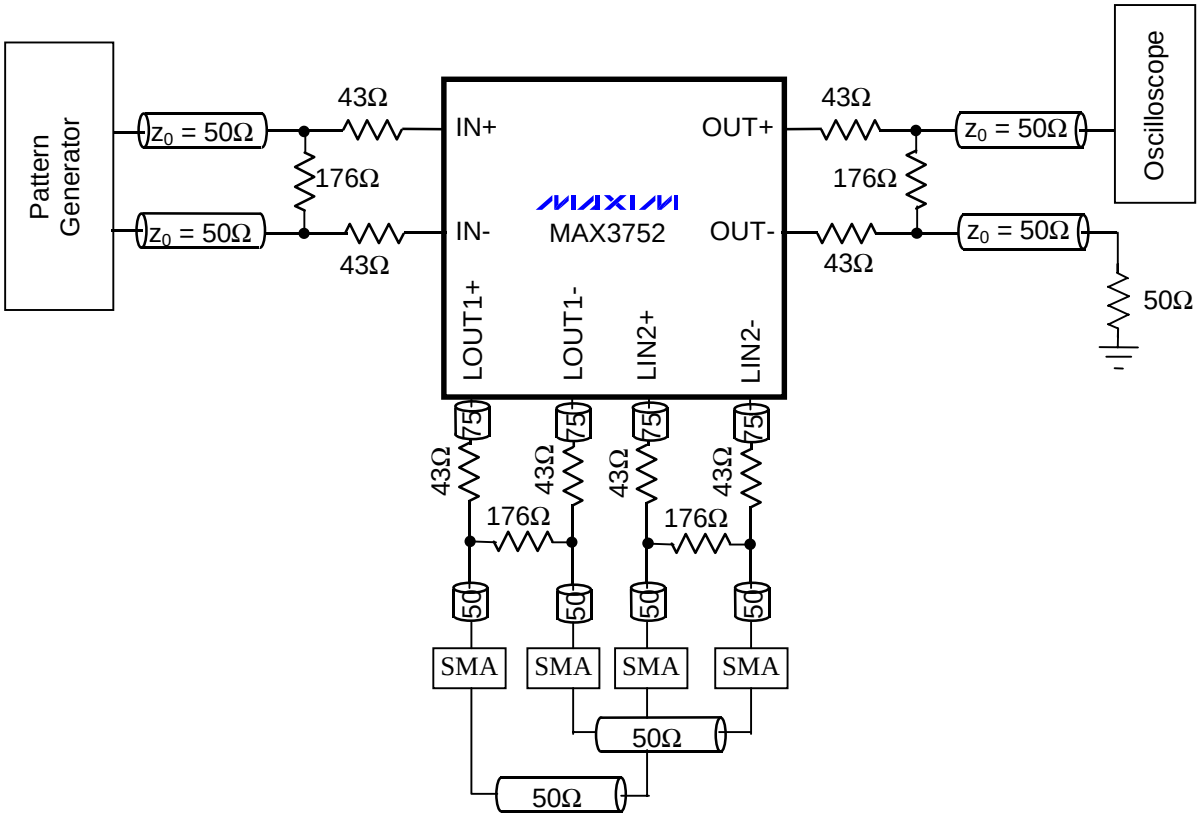
Baseline.tif

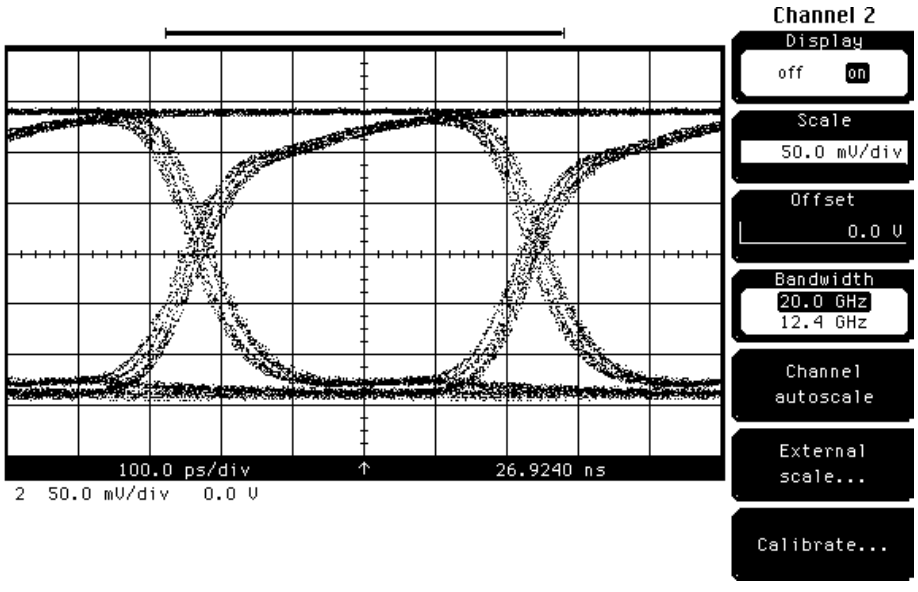
Jitter = 3.4ps (RMS)/22.2ps (peak to peak)

3.2 Experiment 2. Baseline Configuration B

(Unmodified EV kit, port 2 enabled)

The signal was routed out of LOUT1+/- and into LIN2+/- through the EV kit SMA connectors and 17-inch 50Ω SMA cables. Port 2 was enabled.





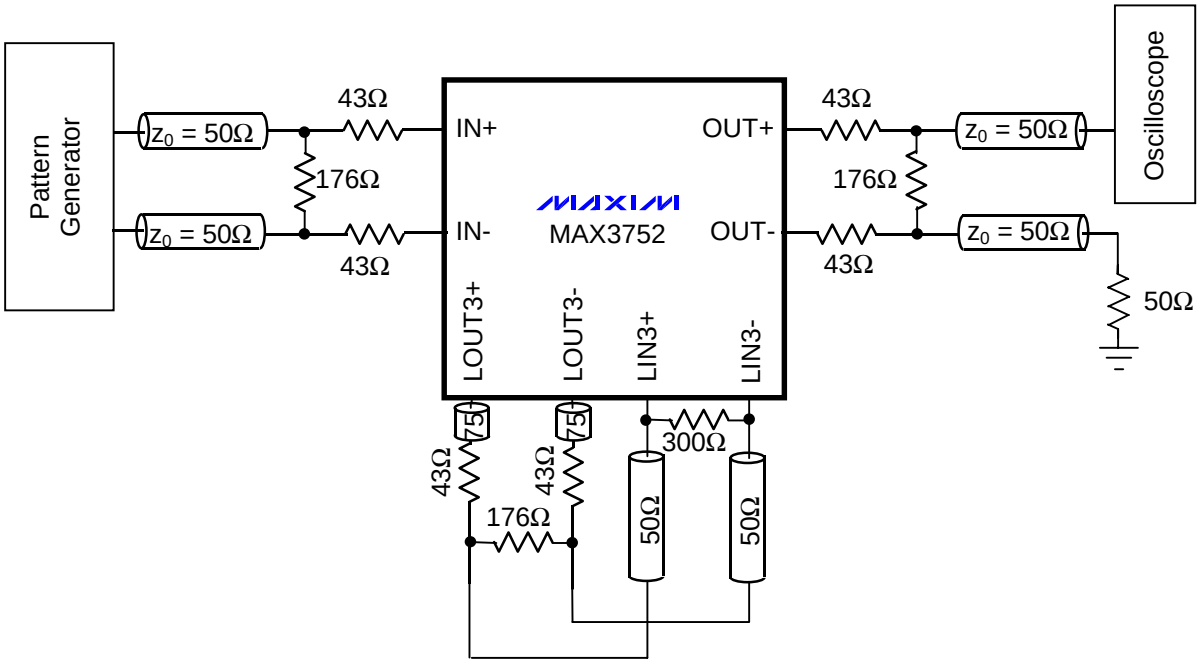
BASEL2.tif

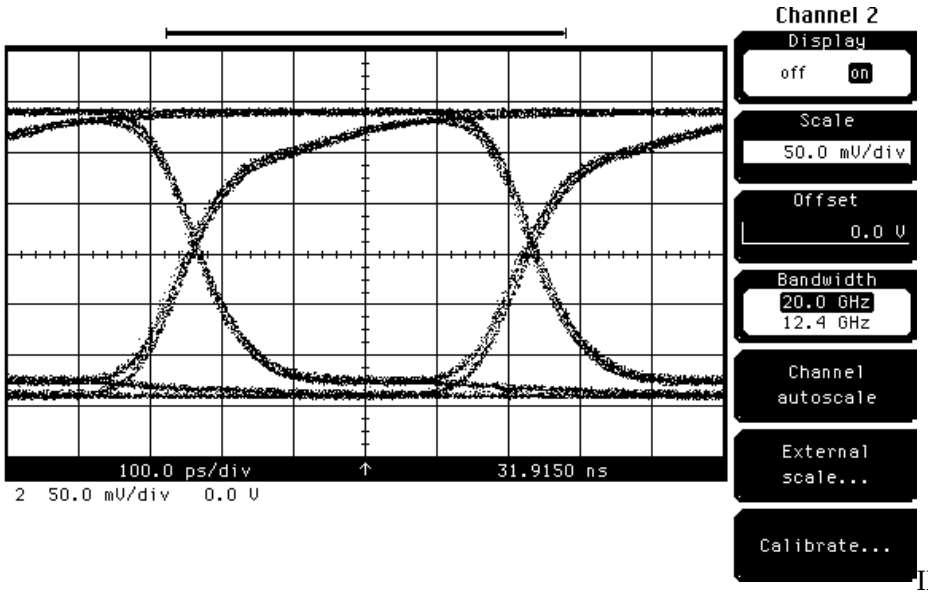
Jitter = 11.1ps (RMS)/44.4ps (peak to peak)

3.3 Experiment 3. 50Ω Transmission Line, Standard EV Kit Termination at Driver, 300Ω Termination at Load

(Modified EV kit, port 3 enabled)

For this test, the EV kit was modified by grinding down through the top layer of the PC board (to expose the ground plane) very close to the pads for the 176Ω resistor at LOUT3+/- and close to the LIN3+/- pins on the MAX3752. Five-inch lengths of 50Ω coax were then attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pads (176Ω resistors and LIN3+/-). A 0402 size 300Ω resistor was soldered across the LIN3+/- pins. Enabling port 3 allowed observation of the effects of the 300Ω termination.



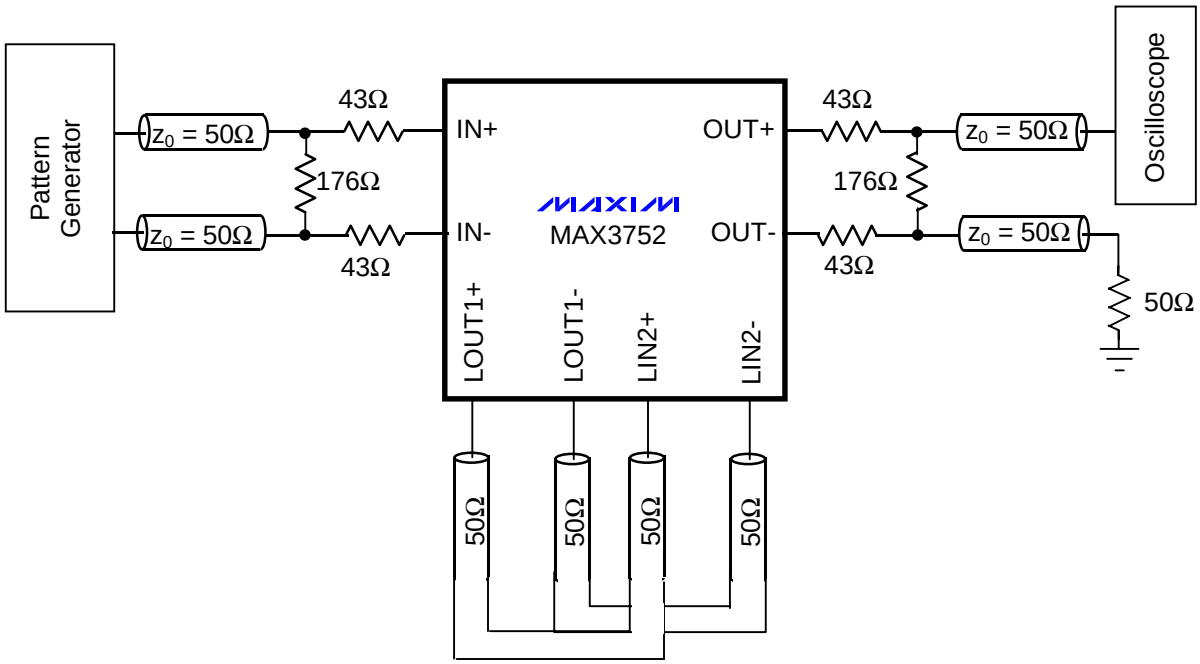


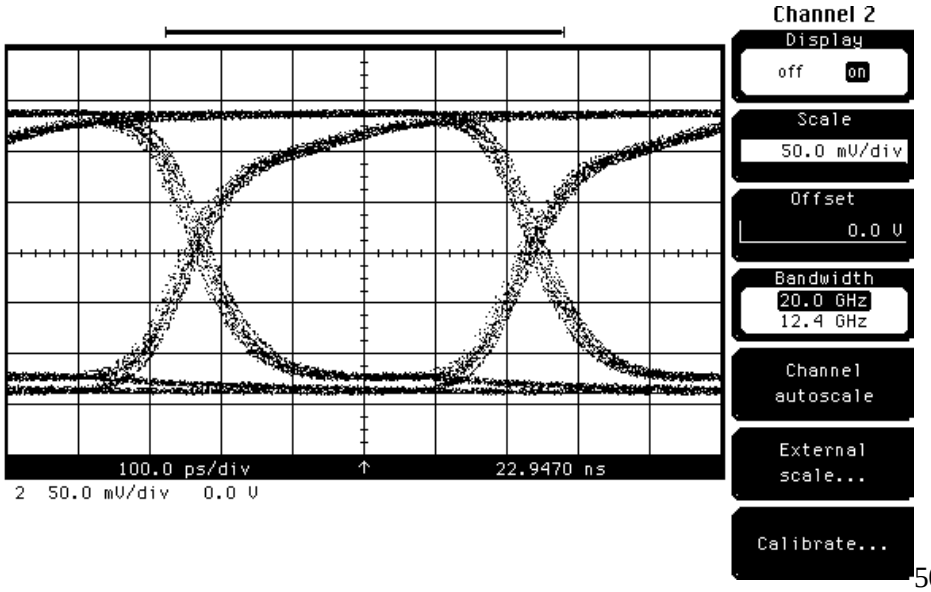
IN300.tif

Jitter = 6.1ps (RMS)/31.1ps (peak to peak)

3.4 Experiment 4. 50Ω Transmission Line, No Terminations
(Modified EV kit, port 2 enabled)

For this test, the EV kit was modified by grinding down through the top layer of the PC board (to expose the ground plane) very close to the LOUT1+/- pins and close to the LIN2+/- pins on the MAX3752. Five-inch lengths of 50Ω coax were then attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pins. Enabling port 2 allowed observation of the effects of the 50Ω transmission lines when no terminations are used on either end.



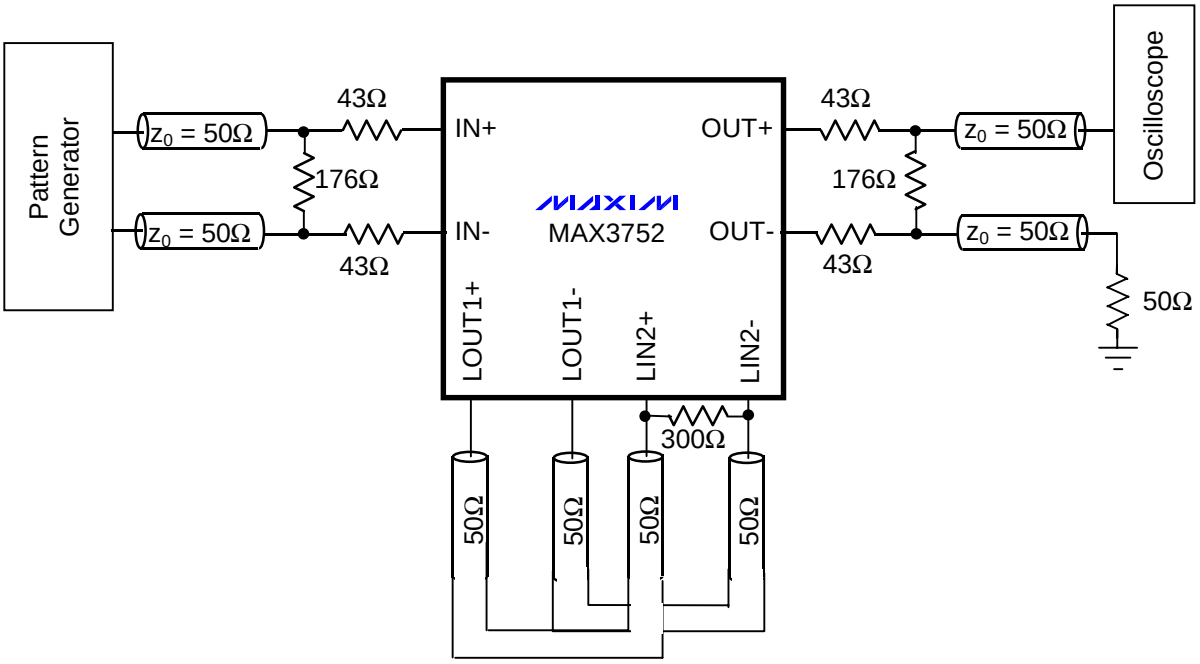


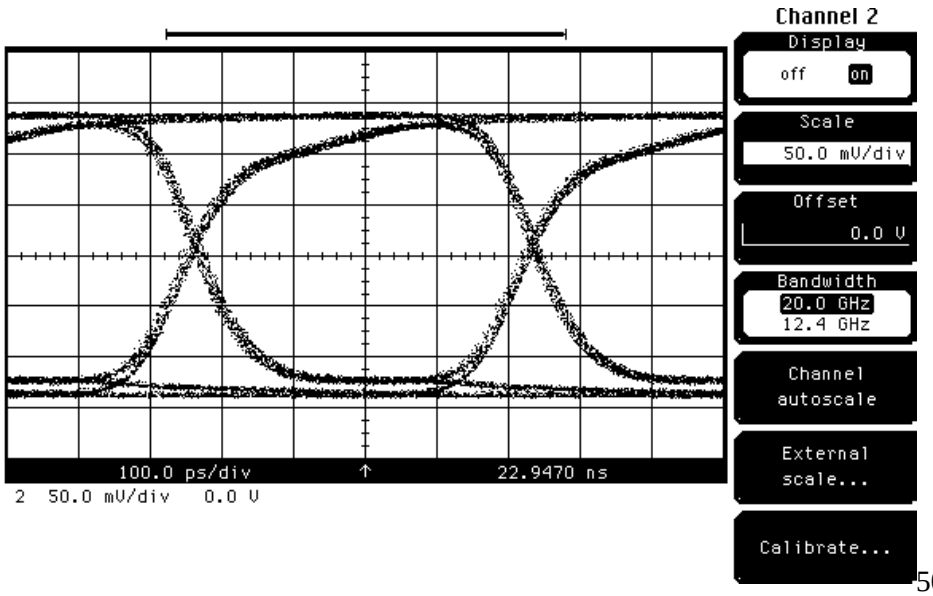
50_NO_NO.tif

Jitter = 9.8ps (RMS)/48.9ps (peak to peak)

3.5 Experiment 5. 50Ω Transmission Line, No Driver Termination, 300Ω Termination at Load (Modified EV kit, port 2 enabled)

The EV kit was modified for this kit by grinding down through the top layer of the PC board (to expose the ground plane) very close to the LOUT1+/- pins and close to the LIN2+/- pins on the MAX3752. Five-inch lengths of 50Ω coax were then attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pins. A 300Ω resistor was soldered across the LIN2+/- pins. Enabling port 2 allowed observation of the effects of the 50Ω transmission lines with no terminations on the driver end and a 300Ω termination on the load end.



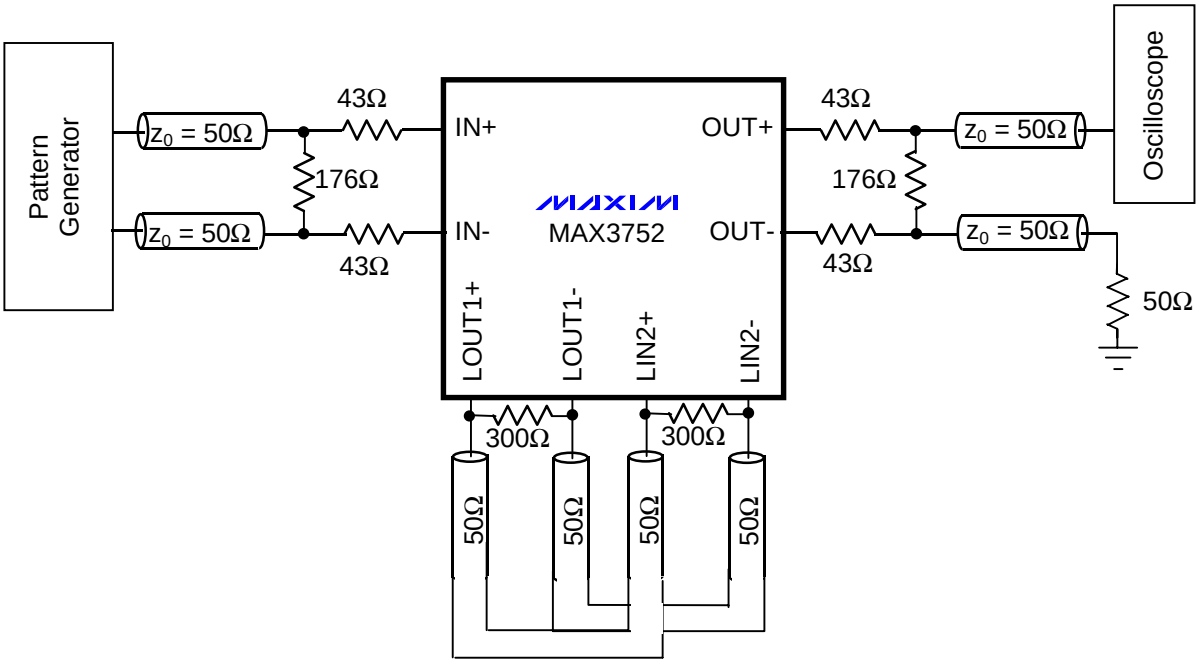


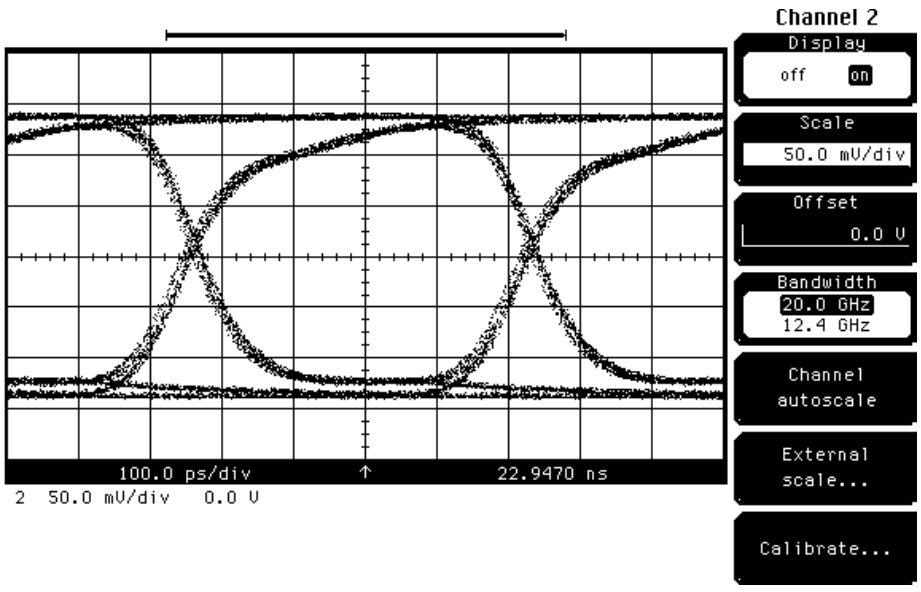
50_NO_3.tif

Jitter = 6.9ps (RMS)/35.6ps (peak to peak)

3.6 Experiment 6. 50Ω Transmission Line, 300Ω Driver Termination, 300Ω Load Termination (Modified EV kit, port 2 enabled)

For this test, the EV kit was modified by grinding down through the top layer of the PC board (to expose the ground plane) very close to the LOUT1+/- pins and close to the LIN2+/- pins on the MAX3752. Five-inch lengths of 50Ω coax were then attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pins. 300Ω resistors were soldered across the LOUT1+/- and LIN2+/- pins. Enabling port 2 allowed observation of the effects of the 50Ω transmission lines with 300Ω termination on both the driver and load ends.



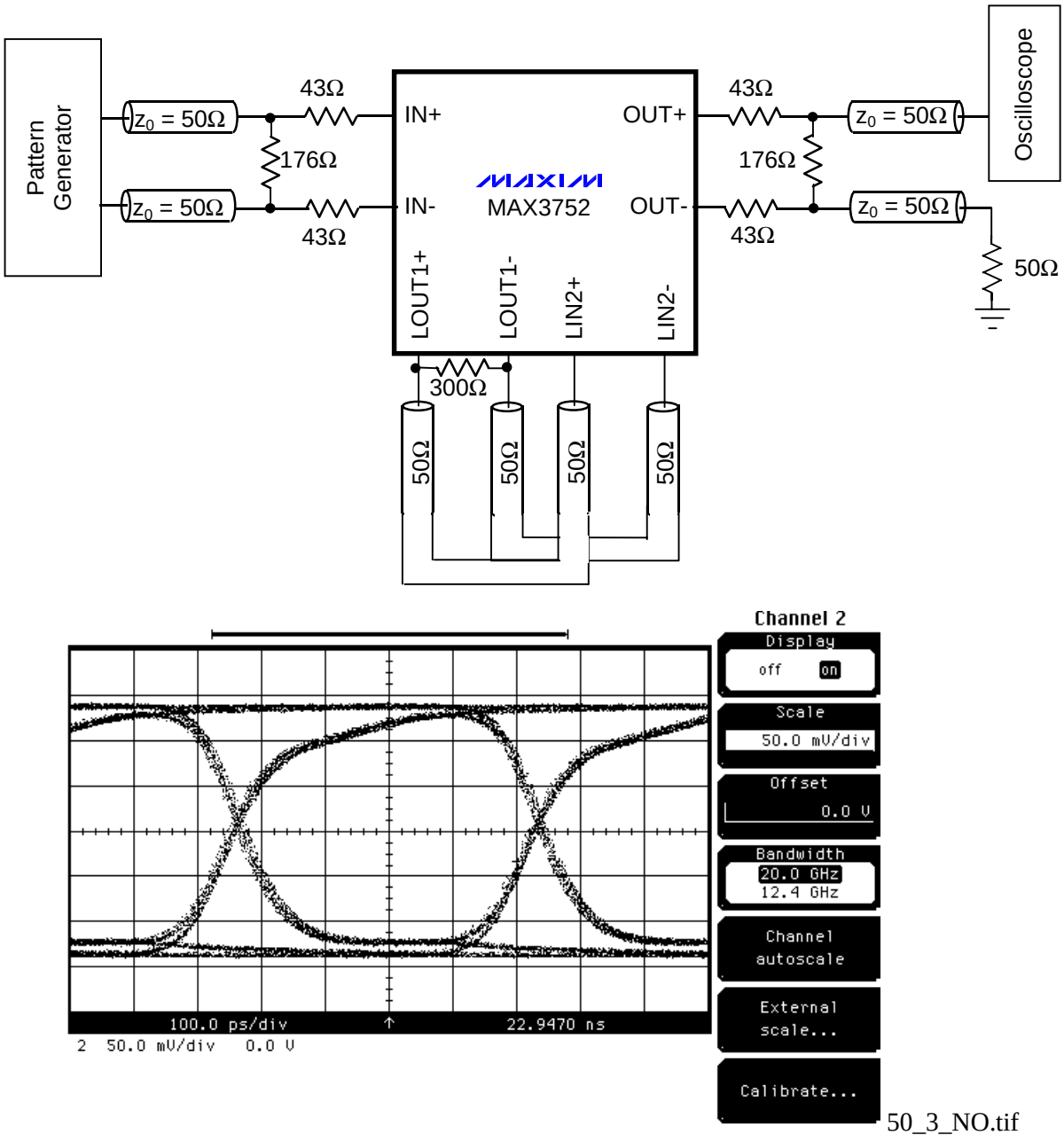


50_3_3.tif

Jitter = 7.0ps (RMS)/35.6ps (peak to peak)

3.7 Experiment 7. 50Ω Transmission Line, 300Ω Driver Termination, No Termination at Load
(Modified EV kit, port 2 enabled)

For this test, the EV kit was modified by grinding down through the top layer of the PC board (to expose the ground plane) very close to the LOUT1+/- pins and close to the LIN2+/- pins on the MAX3752. Five-inch lengths of 50Ω coax were then attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pins. A 300Ω resistor was soldered across the LOUT1+/- pins. Enabling port 2 allowed observation of the effects of the 50Ω transmission lines with 300Ω termination on the driver end and no termination on the load end.

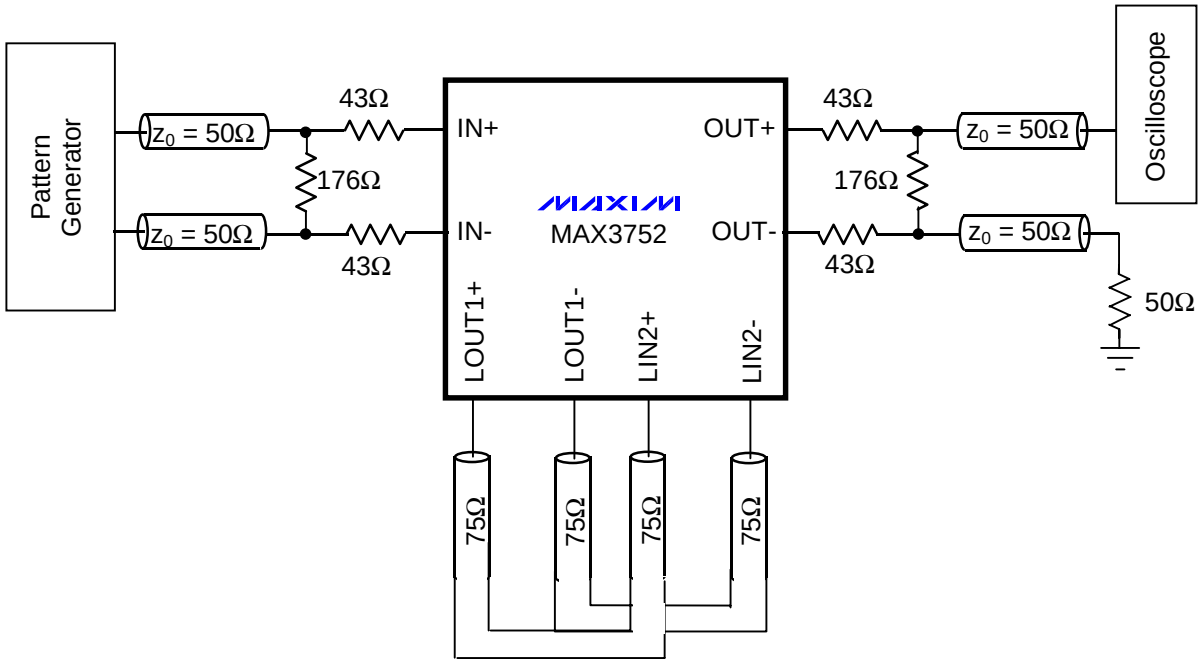


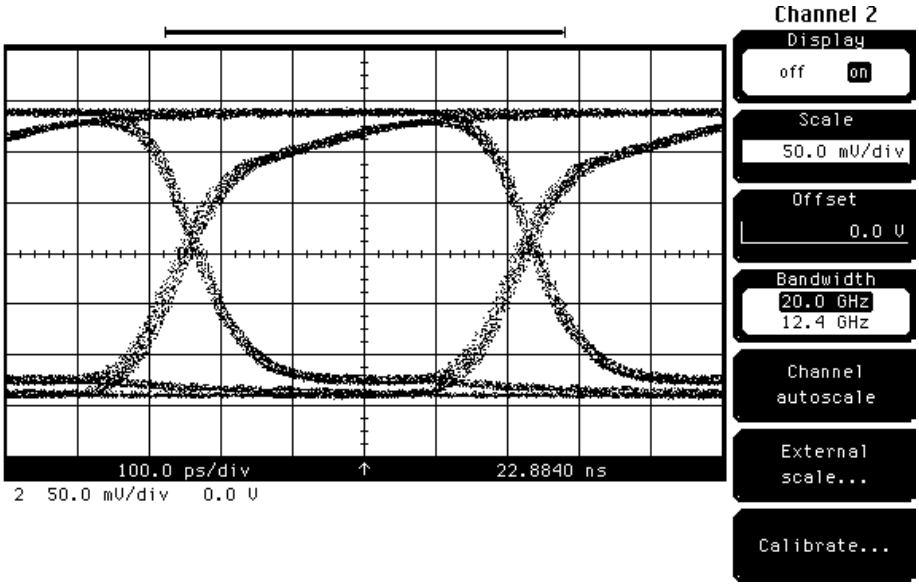
50_3_NO.tif

Jitter = 6.6ps (RMS)/35.6ps (peak to peak)

3.8 Experiment 8. 75Ω Transmission Lines, No Terminations (internally terminated to 75Ω) (Modified EV kit, port 2 enabled)

For this test, the EV kit was modified by grinding down through the top layer of the PC board (to expose the ground plane) very close to the LOUT1+/- pins and close to the LIN2+/- pins on the MAX3752. Then 9.5 inch lengths of 75Ω coax were attached by soldering the outer conductor to the ground plane and the center conductors to the appropriate pins. Enabling port 2 allowed observation of the effects of the 75Ω transmission lines with no external terminations.





75_NO_NO.tif

Jitter = 9.0ps (RMS)/44.4ps (peak to peak)