

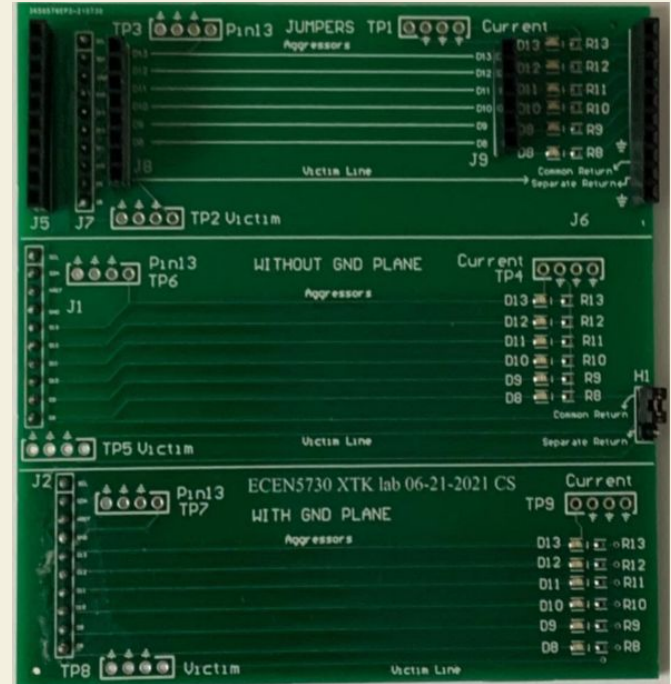
Lab 9 Report: Cross Talk

Utkarsh Mandavilli

Purpose

The purpose of this lab is to explore two different geometries and measure cross talk between one or more aggressor signals when simultaneously switching from high to low and the resulting noise in an adjacent victim signal return path.

The lab uses an Arduino driving a 1V signal that switches from high to low with a period of roughly 120ns on several pins simultaneously. Testing is done through the use of the following PCB.



Cross Talk

- Cross Talk is the unwanted transfer of signals between communication channels
- The aggressor/s are the traces generating a high frequency signal
- The victim is the trace that couples to the aggressor's high frequency signal
- For the circuit used on the PCB, the following formula can be used to calculate voltage on the victim line:
 - $V = M * n * (dI/dt)$
 - M: Mutual loop inductance between aggressor and victim loops
 - n: Number of switching aggressor signals
 - dI/dt : Change in current with respect to time of the aggressor signal

First Case: Separate Shared Return Trace

The first of the interconnect patterns is a separate trace. This means that each signal uses a routed return trace on the board. In this case, both signals share a return trace. The aggressor is shown in green and the victim is shown in yellow. This setup has the most cross talk since the mutual inductance is at its highest.



Second Case: Separate Non-shared Return Trace

This case also uses a separate return trace, however each signal gets its own routed return trace. The aggressor is shown in green and the victim is shown in yellow. This setup has less cross talk than the first case since the mutual inductance is lower however the inductance is still quite high due to the length of the return paths.



Third Case: Continuous Return Trace

The second interconnect pattern is a shared ground plane, meaning that both the aggressor and victim signals use the same continuous ground plane as their return path. The aggressor is shown in green and the victim is shown in yellow. This setup has the least cross talk since the mutual inductance is at its lowest. This is due to the common ground being directly under the signal trace.



Conclusion

- As shown by the measurements taken of the victim line under the different cases, the best practice is to use a shared return plane to minimize cross talk
- Cross talk is managed by minimizing the mutual inductance between the aggressor and victim loops
- If using separate return traces, it is important to make sure that the traces have a decent amount of space between them
- Although it is not possible to completely eliminate cross talk when working with high-frequency switching signals, steps can be taken to mitigate its effects on nearby signals.