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High Speed Connector SI Round-Up | Presenter: John Abbott

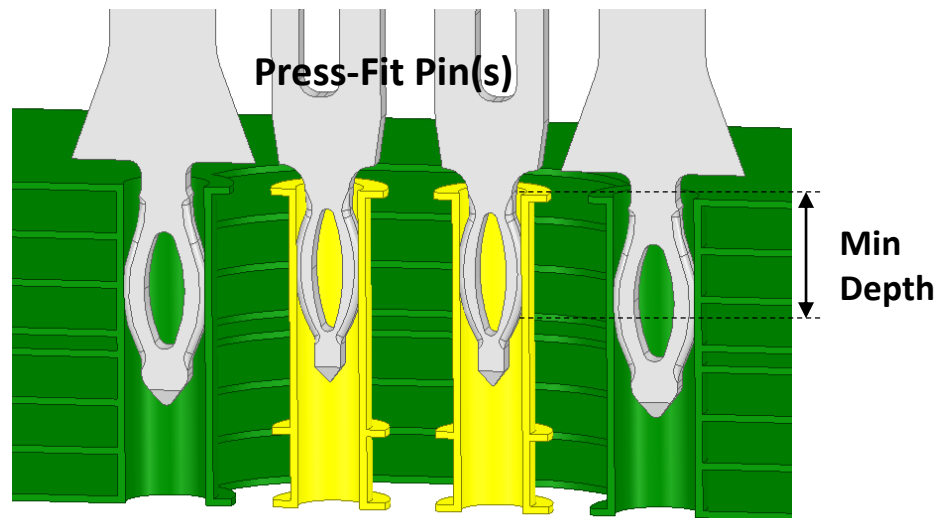
INTRODUCTION

- PCB Connection Types
- Wipe Impact and Mitigation
- Open Pin Field vs Dedicated Grounds
- Edge Card vs Direct Connect



PCB Connection Types

Press-Fit



Pros:

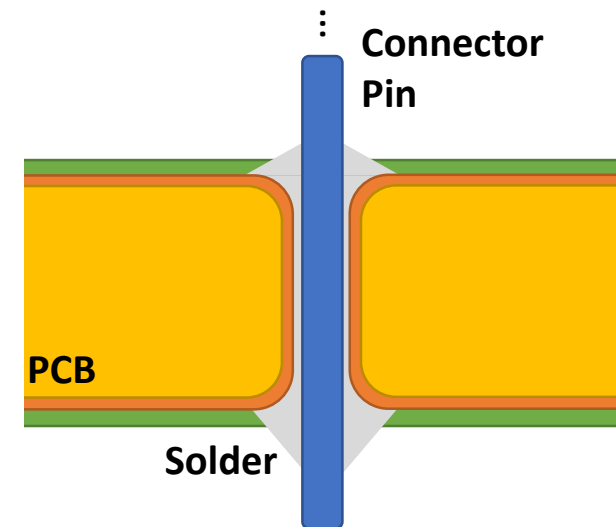
Mechanically strong.
Can be assembled without re-flow, & reworked by hand.

Cons:

Pressfit pins are large and require large vias.
Pressfit pins have a minimum via depth requirement.

-Vias stubs on upper layers cannot be mitigated

Plated Thru Hole (PTH)



Pros:

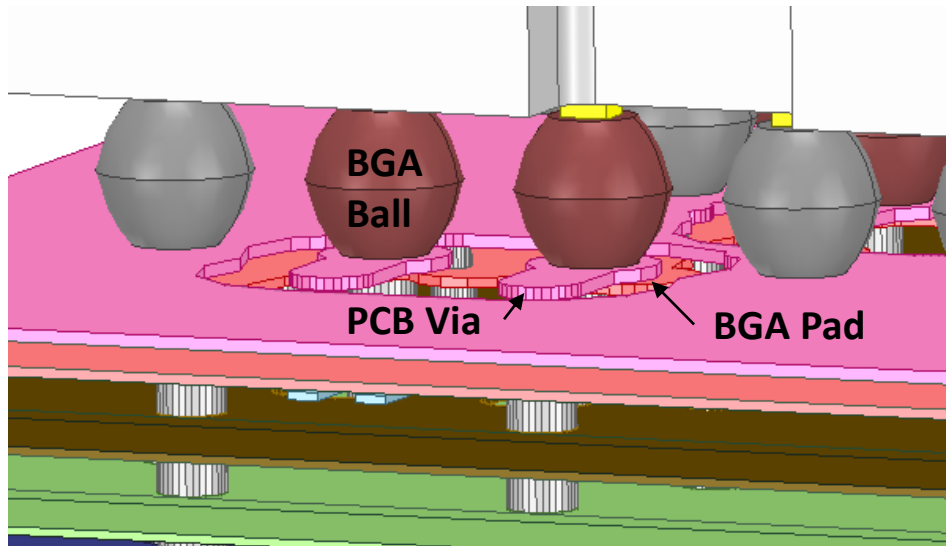
Typically smaller via sizes than press-fit.
Mature technology.

Cons:

Back-drill limitations make this difficult to implement at today's fastest data rates.

PCB Connection Types

Ball Grid Array (BGA)



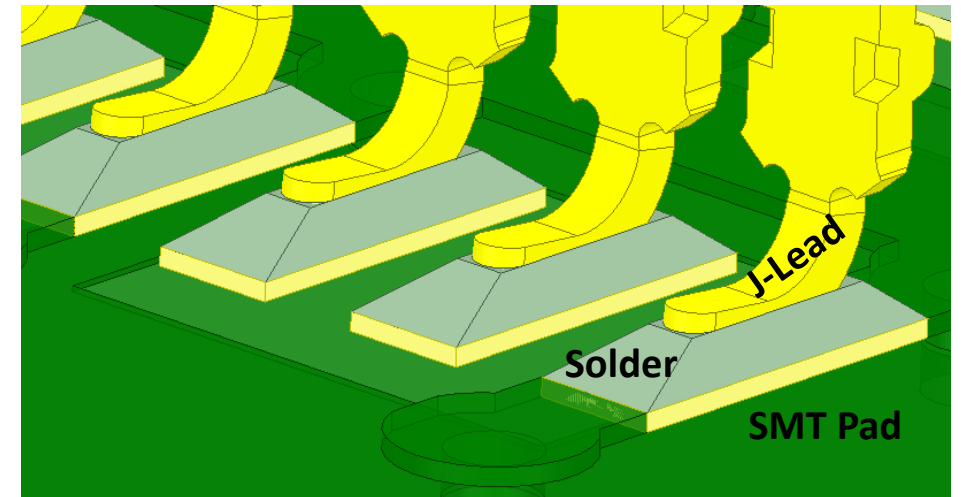
Pros:

- Mounted on PCB surface.
- Small landing pads, least invasive to SI.
- Small pads enable higher density connectors.

Cons:

- Additional assembly complexity.
- Can struggle with large amounts of mechanical stress.

Surface Mount (SMT)



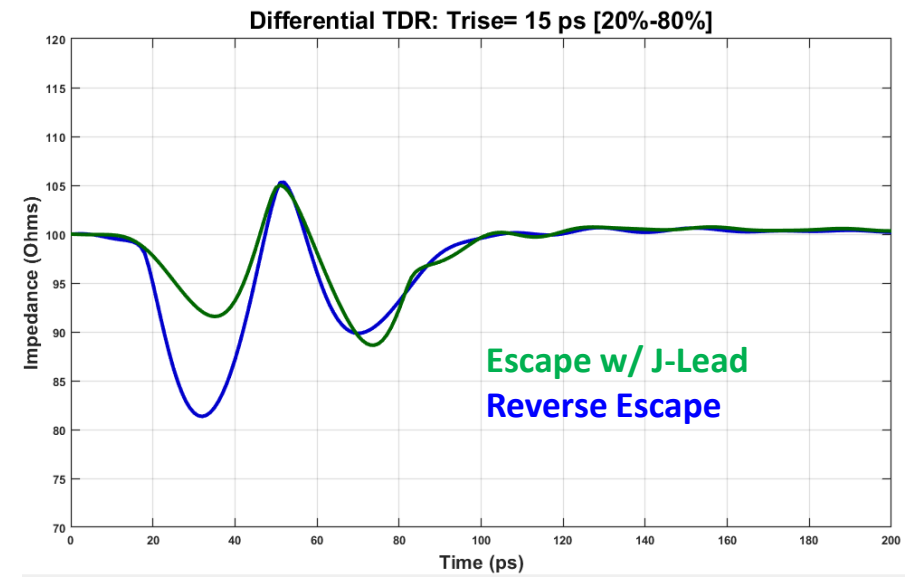
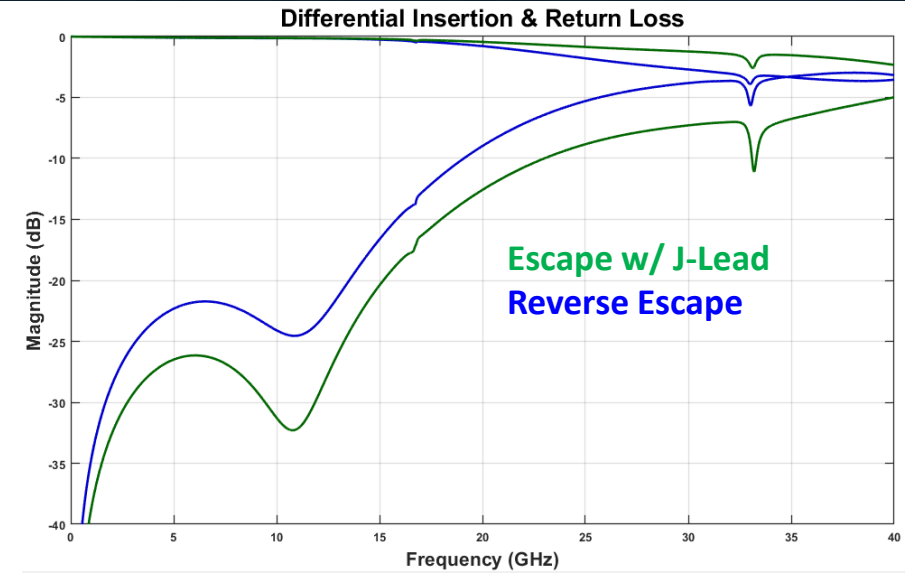
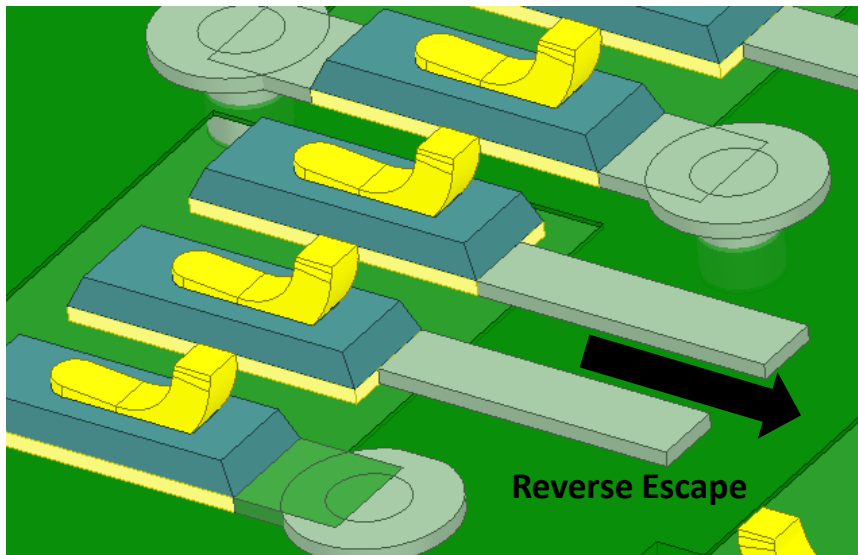
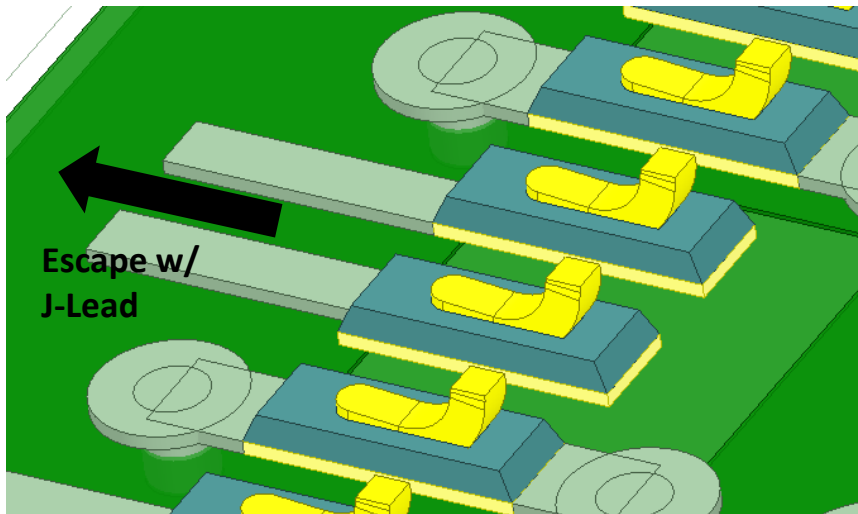
Pros:

- Mounted on the PCB surface.
- Layer transition vias are only limited by PCB technology.

Cons:

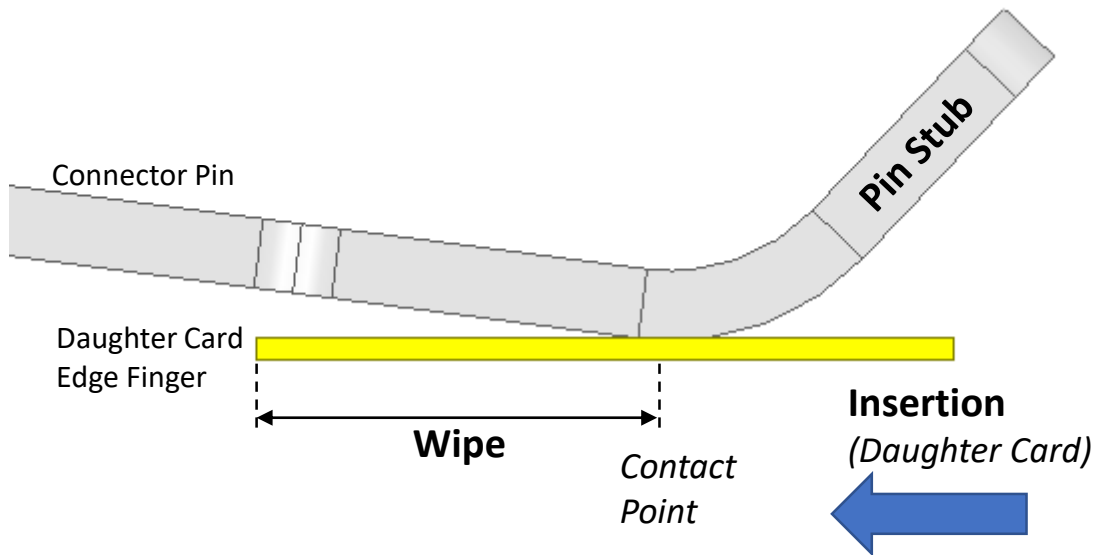
- Requires large surface mount pad that can be difficult to optimize for SI.
- Trace escape direction can be impacted by J-lead orientation.
- Connector density limited by SMT pad size.

SMT Escape Direction Impact



Contact Wipe

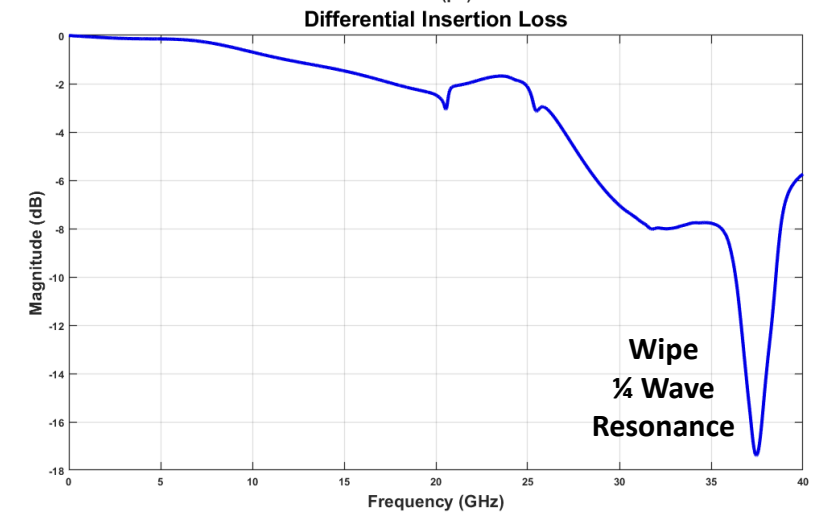
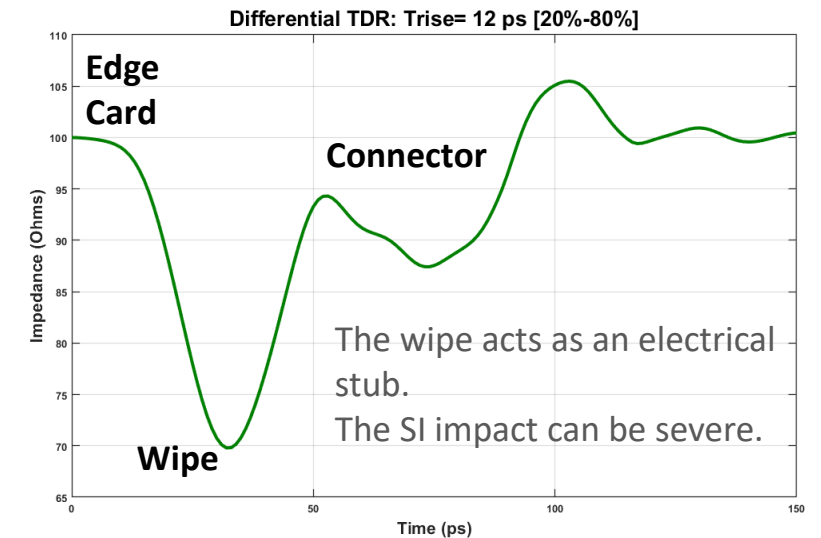
What is Wipe? (Edge Card Example)



The wipe serves several functions:

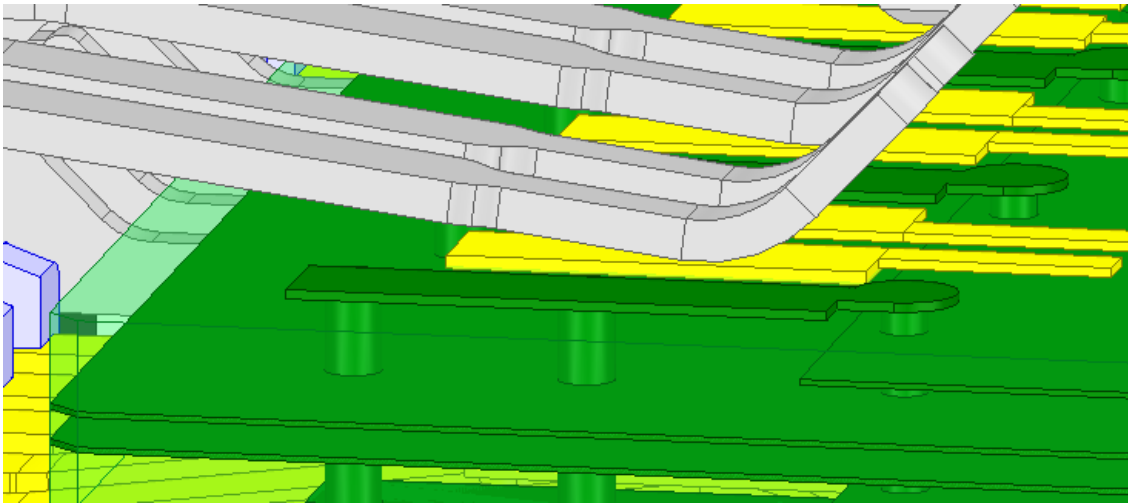
- Cleaning the pin tip surface, and developing a burr on the metal surfaces.
- Needed for mechanical tolerances across the connector & system stacks.

SI Impact



Wipe Mitigation

Optimization

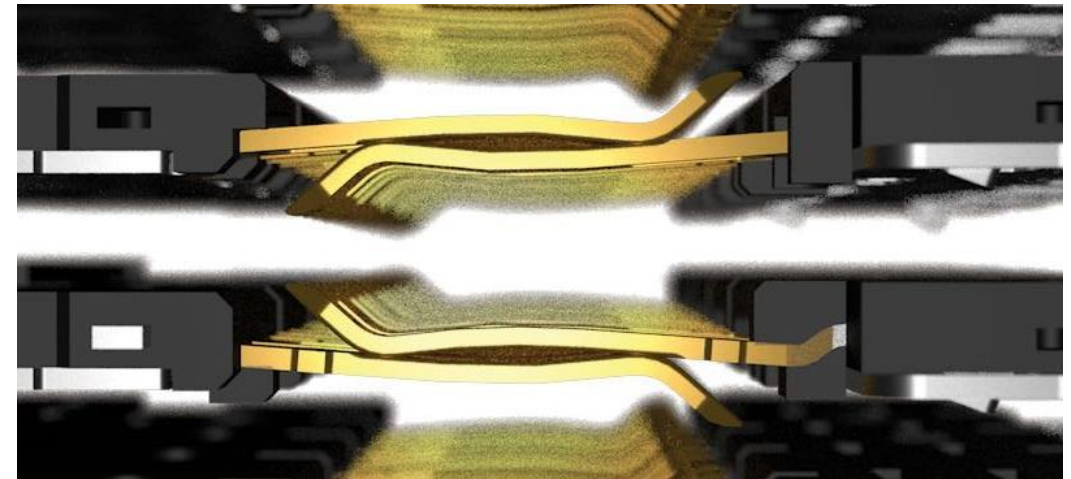


Edge Card Optimization Example

Lots can be done to reduce the wipe impact, for example:

- Voiding the ground underneath the edge fingers.
- Reducing the pad width.
- Using pre-wipe pads (edge card).
- Optimizing the ground structure.
- Using lower Dk dielectric materials.

Double-Touch Contact System



Pros:

Wipe stub impacts can be mostly eliminated.

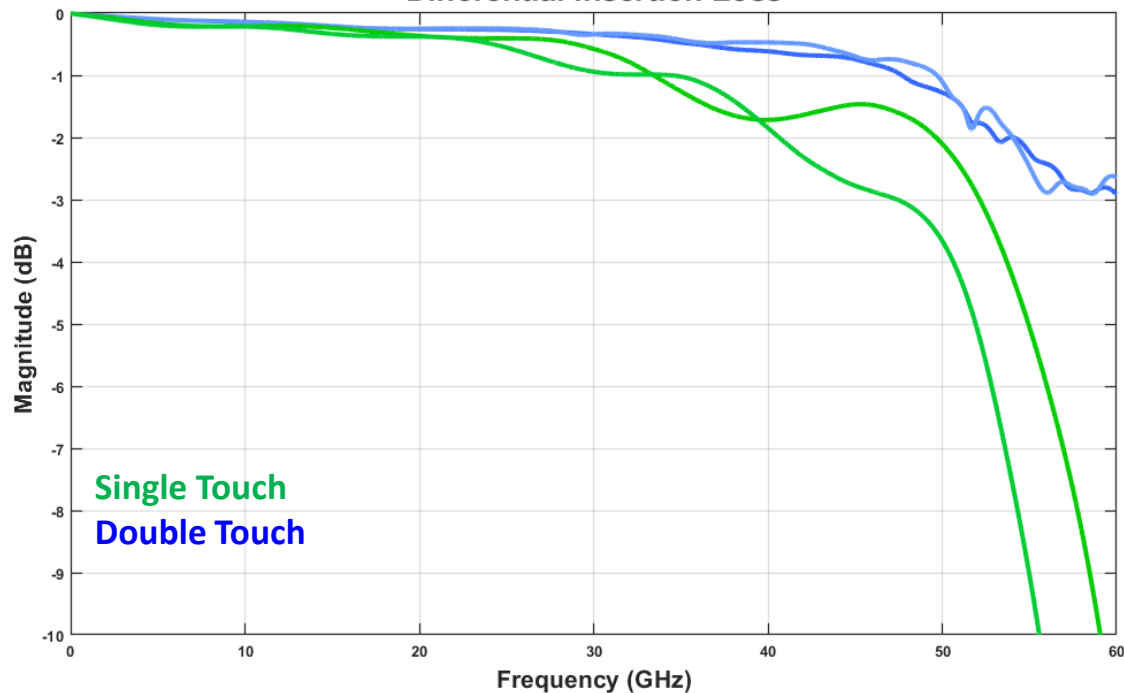
Cons:

Takes up more space, can be an issue on fine pitch low profile connectors.

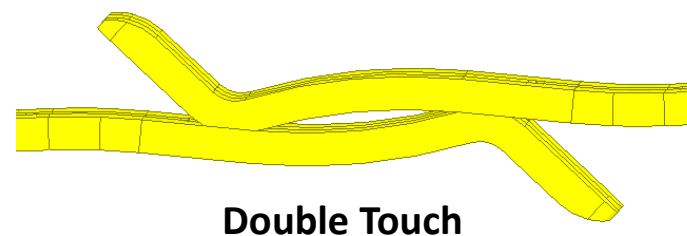
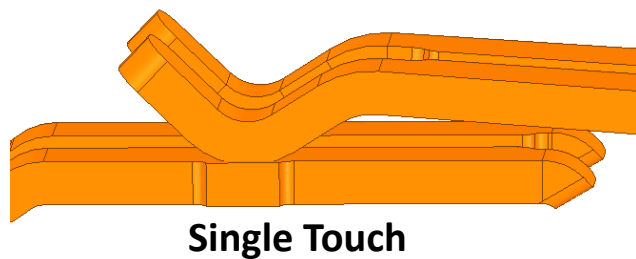
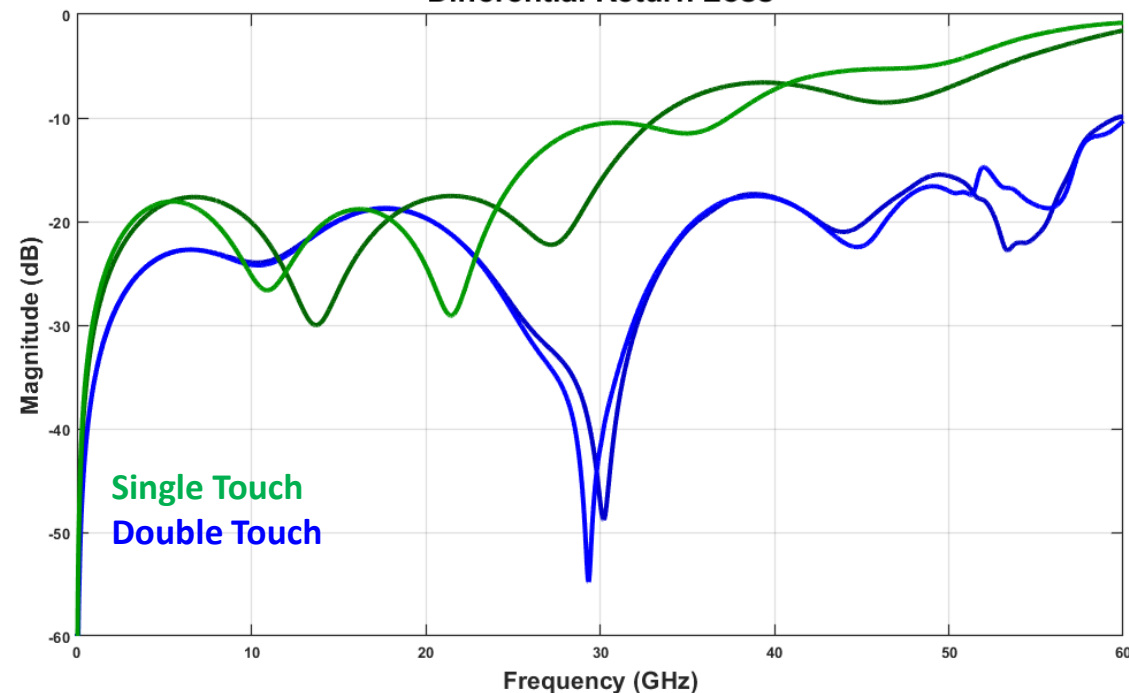
Increased complexity, and cost. Typically seen in applications with large wipe requirements, like back plane.

Double-Touch vs Single-Touch SI Performance

Differential Insertion Loss

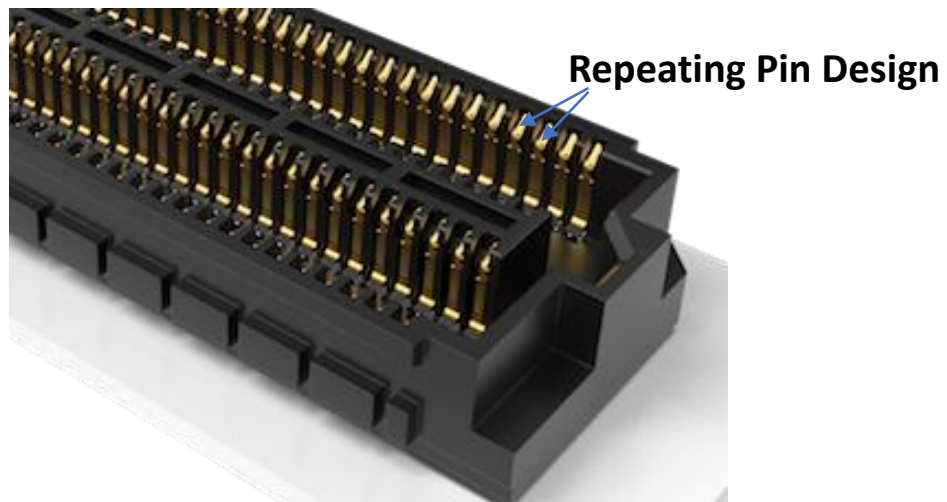


Differential Return Loss



Open Pin Field vs Dedicated Grounds

Open Pin Field



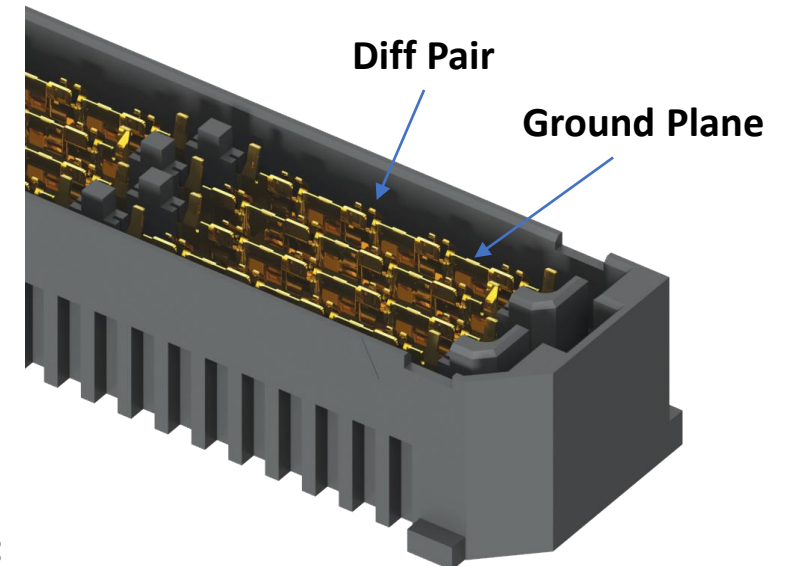
Pros:

Ultimate in flexibility. (Mix high speed diff, low speed and power.)
Higher density potential.

Cons:

Best performance may require sacrificing pins for additional ground.
Limited connector design options, e.g. no ground planes or pin asymmetry.
Very difficult to design in certain form factors (like right angle & tall stack heights).

Dedicated Grounds



Pros:

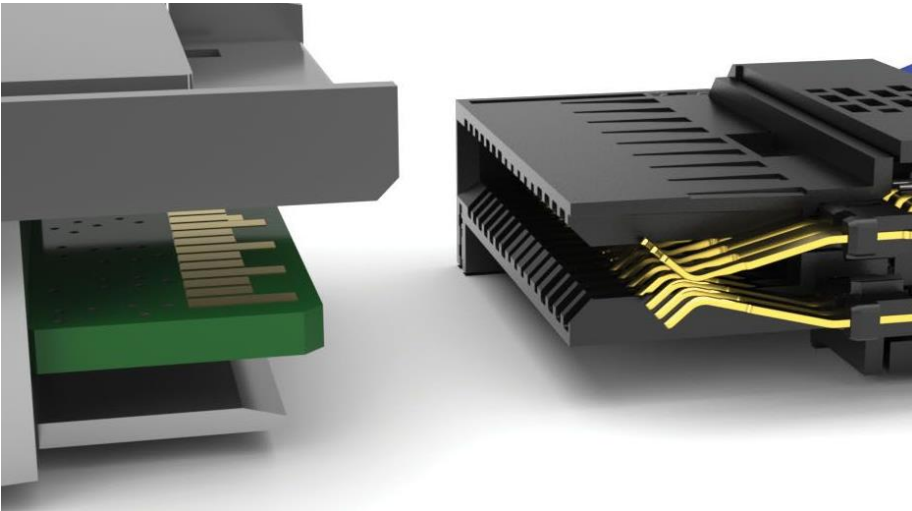
Highest SI performance potential.

Cons:

Less flexibility for non-differential signals.

Edge Card Design vs Direct Connect

Edge Card



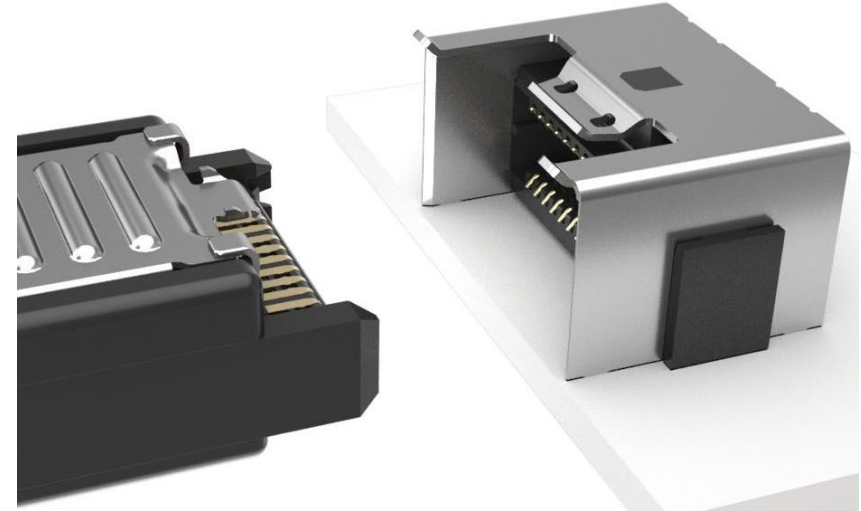
Pros:

Low cost.
Flexibility of having a PCB. (passive/active components support).

Cons:

Single point of contact, wipe must be mitigated.
Optimization costs can be pushed to edge card PCB.
Can be sensitive to PCB implementation.

Direct Connect



Pros:

More advanced contact structures can be used. (Higher frequency potential).

Cons:

Difficult to support additional components in the connector. (like R,L,& C).
Higher cost.



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