Practical Tips To Minimize Quality Issues In Connectors

If you're reading this, chances are you work with board level interconnects and are familiar with design and processing issues that affect them, or you want to learn more.

This article is a list of tips and suggestions to help designers select the right connector system for their application.

Phil Eckert, Samtec's Customer Quality Engineering Manager, is sharing advice on points to keep in mind when evaluating, selecting, and processing connectors. While all of the points discussed relate to Samtec connectors, they probably apply to most board-level interconnect products, whether they come from Samtec or not.

Phil's career includes connector design, quality management, and tons of experience processing connectors on boards. The goal is to help you eliminate potential quality issues by reducing variability.

Selecting and Processing Connectors

1. **Shorter is better.** The longer the connector, the more problems are experienced with coplanarity, soldering, and board-to-board or connector-to-connector alignment. If you need 20 pins, use a 2 X 10 connector instead of a 1 X 20. (That's why Samtec offers most basic connectors in single, double, or triple row. **Here's an example**).

2. **Follow the recommended footprint** and stencil recommendations closely.

3. **Anything added to the base connector** is an opportunity for problems. Alignment pins, kapton pads, pick and place pads, end shrouds, etc., can all potentially create manufacturing and quality issues. If you do not need them, do not ask for them.

4. **Stacking up tolerances is problematic.** For example, if you have one long edge card mating to three different connectors, the tolerances can stack up and create mechanical interference problems. If possible, it is better to have three independent edge cards in the example used.

5. **Read the notes carefully** on drawings and recommended stencil and PCB layouts. Review our "Tech Spec" pages when considering placing several of the same connectors on boards. (A "Tech Spec" page includes all relevant drawings, test reports, performance, standards, 3D models, pricing, etc., for each product series. Here's an example of a **Tech Spec page for our HSEC8 edge card product**). This becomes more important as pin count increases and connector size decreases. In some cases, connector tolerances can "fight" against each other if they are not placed in the recommended manner. Also review and follow the recommended PCB and stencil design. (Here's an example of a **recommended footprint on a SEARAY™ connector**).

6. **Most connectors have been tested with IR reflow**; few of these connectors used vapor phase soldering when tested.

7. If you do not need Au, especially on the solder tails, specify Sn instead. **Au in solder joints is more prone to problems when compared to Sn.** Selecting the right connector often involves a cost consideration, and **plating can be a significant cost factor.**

8. Design standoffs that do not interfere with the mated height of the connectors (the Z axis). **Standoffs should also allow for the connectors to freely mate** in the X and Y directions

9. Connectors are made of plastic. **Plastic will crack, break, warp, bend, etc., if misused**. Mating and un-mating at angles tends to promote plastic damage. Be gentle!

10. Related to #9, the contacts and terminals (pins) in connectors are small and made of very thin copper. **Abuse will bend these contacts and terminals.** Be gentle!

11. **Never pull on the cable to un-mate a cabled connector**. When the cable is pulled, unless there is strain relief, the cable is being pulled away from its termination. This is more problematic on non-soldered cable terminations like IDC connectors. Your parents probably told you to not unplug the lamp by grabbing the cable; it's the same idea.

12. **Tape and reel pockets are designed for vacuum pick-up and not grippers.** If grippers are used on pick and place equipment, specially design pockets may be needed.

13. **The best predictor of connector performance is normal force.** If given the option between two connector series and all other attributes are equal, choose the one with higher normal force. This is important in harsh environments and keenly important if the environment will experience temperature extremes or have high shock and vibration. **Normal force** has been called the "single best predictor of connector performance."

14. **Be cautious about relying on a fine pitch connector**, those that have a pitch less than .050" (1,27 mm), as being the sole means of mechanical stability between large or heavy PCB assemblies. **The bigger the better.** Yes, the connectors are sturdy and probably well-designed, but you're still asking a small component to support a lot of weight and torque.

15. **Unspent flux** is problematic in connectors from both a mechanical interference and corrosive nature. This can result in product failures in the field.

16. **Plating Tip #1: A SnPb finish is still the superior finish** on solder tails and solder paste. Use it if you can. Although there are possibly many restrictions, use it if you can. And use a nitrogen reflow environment as opposed to air; nitrogen is much better.

17. **Plating Tip #2:** In high reliability applications, thicker Au, **more points of contact,** and higher **normal force** are recommended. There is some truth to the old adage of "You get what you pay for." Check the test reports for which plating style (Au thickness) was used to better understand the expected success of the connector in application.

18. **Ch-Ch-Ch-Changes:** When selecting catalog standard parts, EOEMs have no control over changes to a connector, unless other agreements have been made previously with the connector manufacturer. Samtec attempts to give customers advanced notice of any form, fit, or function changes, but there are the (extremely) rare occasions where important changes are made with short notice.

19. **Don't Push It:** Be cautious about using the connector in a manner more strenuous than what the manufacturer tested. If the test report lists 100 mating cycles, using the connector in an application with 150 cycles means you are treading into the unknown. In a case like this, it is best to ask the connector manufacturer for a recommendation. But if you don, it's probably safe to expect a conservative answer. And if you receive an answer that sounds a little too optimistic, be careful. (**Here's a link** if you want to see examples of Samtec test reports available)

20. **It's Probably Not Tested To Failure:** Connector qualification testing was designed to match the expected conditions that the vast majority of users will subject the connector set to. It is not possible to test the connector to every unique application or to test connectors to failure.

21. If there is a **unique application, it is best to ask the connector manufacturer for a recommendation.** Expect a conservative, safe, recommendation. Some tests are significantly influenced by the weight and geometry of the PCB or assembly: shock and vibration testing for example. If you are interested in knowing when a connector will fail, expect to be asked to https://www.samtec.com/products/seaf#testreportsSeriesparticipate in custom testing.