Comment on BAW PCB Layout for RF Filters
Triquint Semiconductor
6/30/09

BAW filters are comprised of resonators that operate at frequencies that are typically between 400MHz and 12 GHz. Near the desired frequency, the resonators' acoustic properties dominate the filter response. Outside the desired frequency, these resonators become capacitors and are susceptible to the same EM rules that apply to all passive components.

For this reason, BAW filters are sensitive to EM feedthrough and ground inductance. EM feedthrough occurs when there is an EM coupling between the input and output ports. There is always a capacitance between the ports. The higher the capacitance value, the more feedthrough there will be at a given frequency (or the lower the frequency of a given feedthrough value). If the feedthrough value of the filter on the PCB is less than that of the filter itself, some rejection will be lost.

For example, if the filter rejection is -60dB and the feedthrough on the PCB is -40dB, the filter will appear to have only -40dB rejection. The feedthrough becomes the noise/rejection floor.

For best EM feedthrough (crosstalk) protection:

- PCB should contain both a top and bottom ground plane connected with at least a row of plated-through vias running underneath the filter's ground pad. This will provide ground isolation between input/output ports.
- Input / Output traces should be kept as far apart as possible. More distance reduces capacitance value.
- Input matching inductors, if possible, should be perpendicular to output matching inductors to prevent mutual inductive coupling.

When the filter ground is impeded by a small inductance, the current to ground is distributed back to the filter, causing a ground loop. This loop will create a feedthrough mechanism. Any inductance from the filter's external footprint to the reference ground is considered a common ground inductance because it is common to all resonators within the filter (see Figure 1). The higher the common ground inductance, the higher the impedance to ground, and the higher the feedthrough between input/output ports (see 'Effect of Common Ground Inductance on BAW Filters'). Note that the amount of inductance required is **extremely small**.

For best attainable rejection, reduce common ground inductance by:

- Using many parallel ground vias close to or underneath the filter.
- Locating the filter close to reference ground.

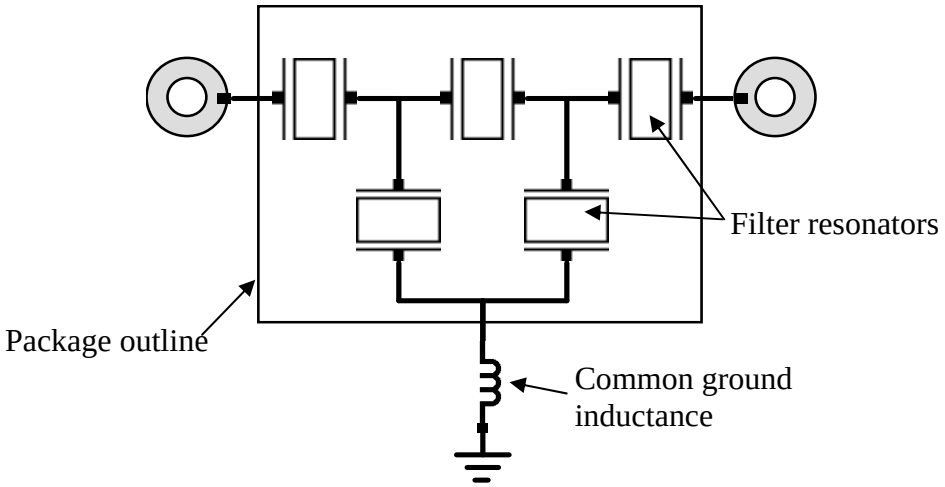


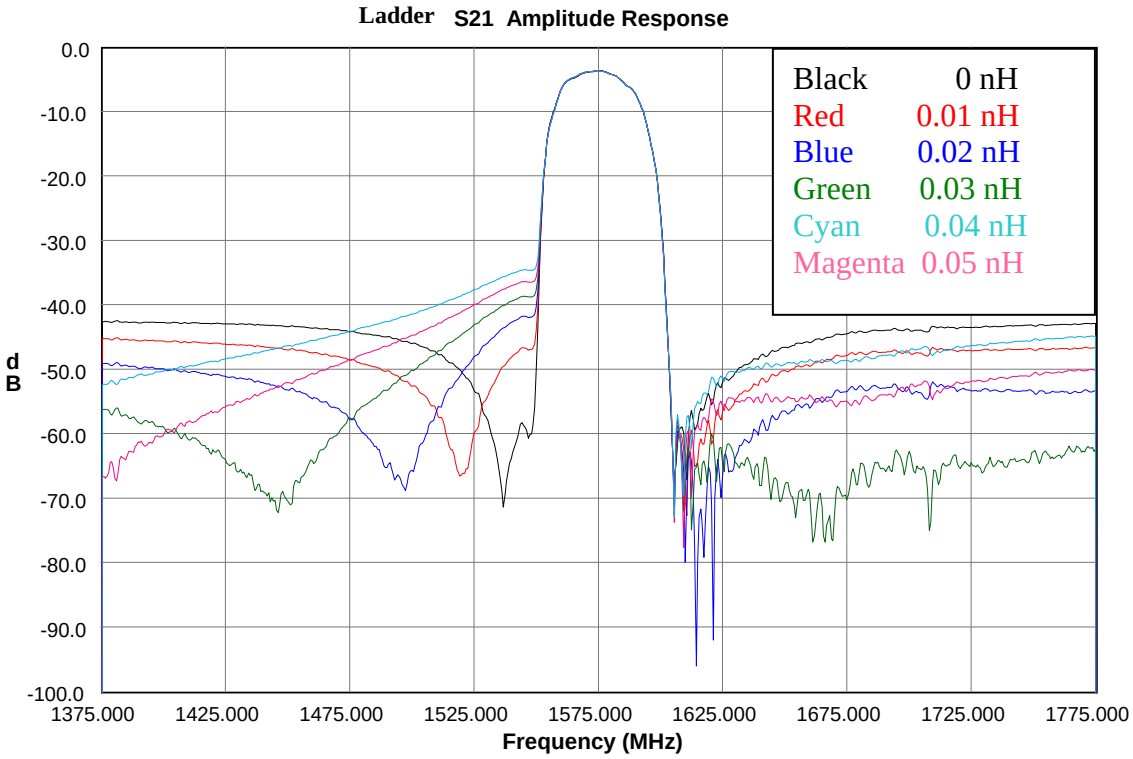
Figure 1

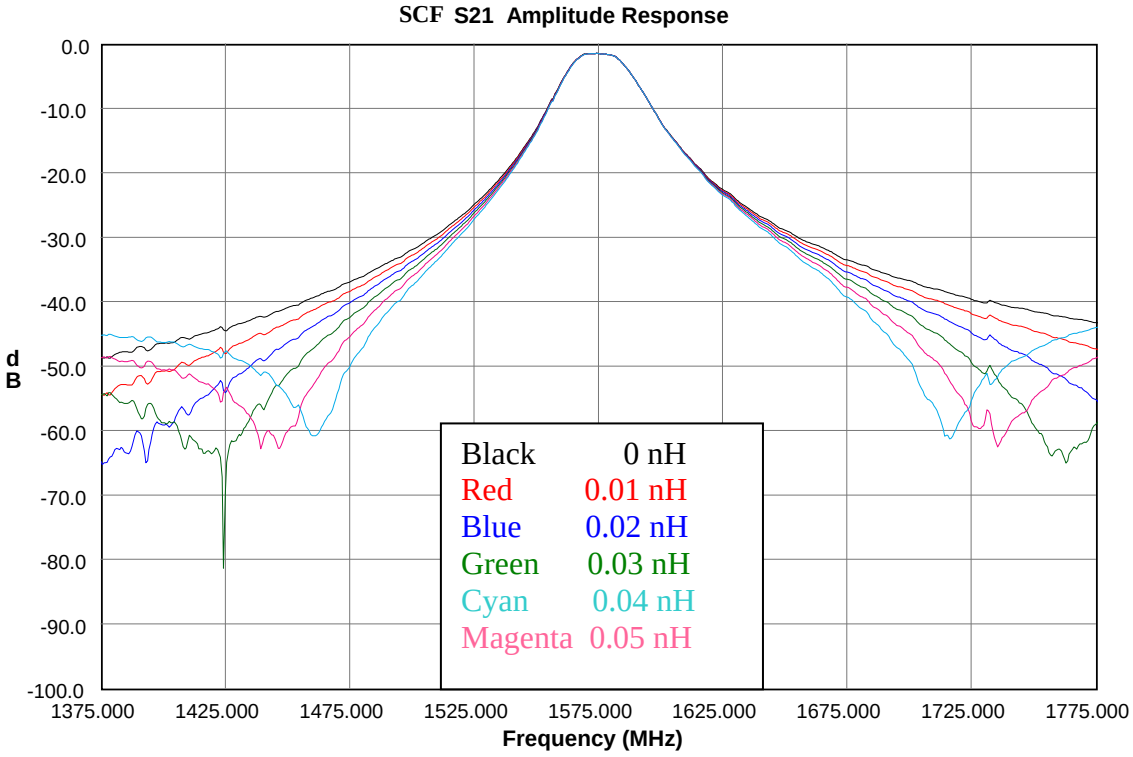
Although BAW filters may have various port impedances, they are typically designed to 50 ohms real. It is important to understand the effects of the PCB trace to and from the filter. This trace will act as a transmission line in that if it does not match the impedance of the filter, there will be an impedance transformation.

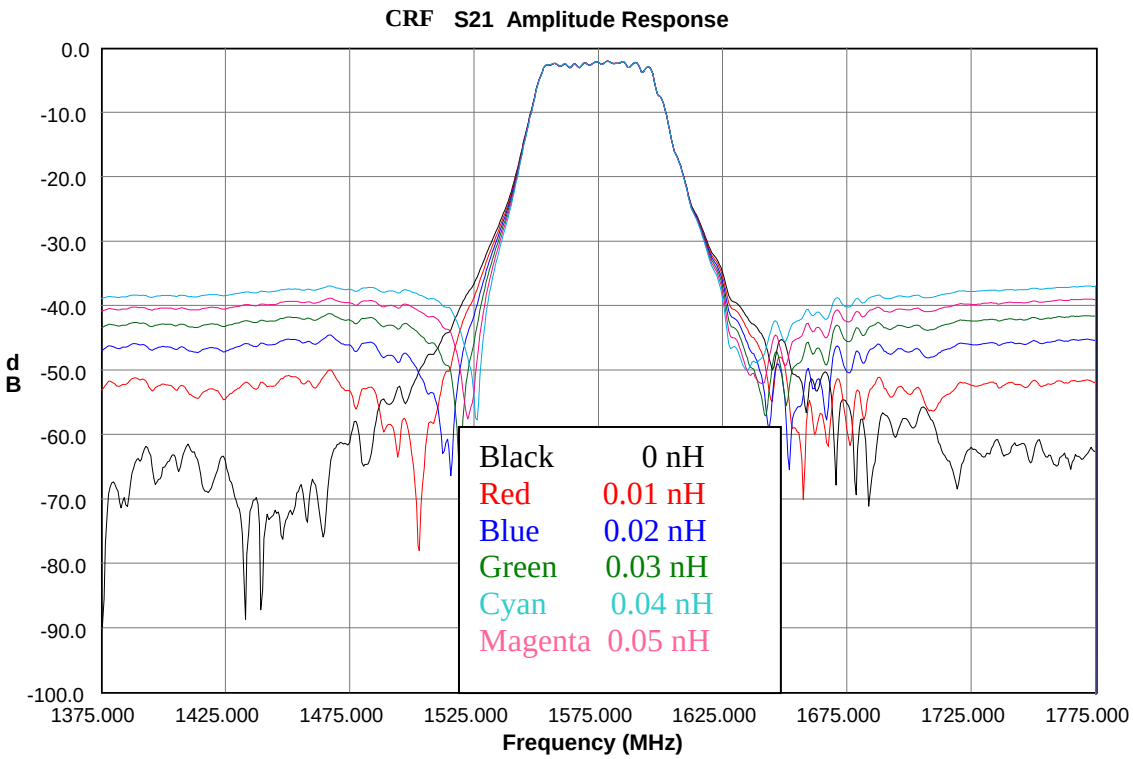
For best passband characteristics:

- Keep matching components as close to filter as possible to minimize undesired impedance transformations.
- Maintain correct impedance on input / output PCB traces.

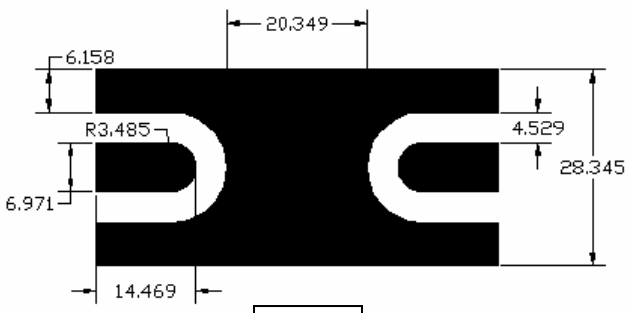
Effect of Common Ground Inductance on BAW Filters







Recommend PCB Footprints
For TriQuint BAW Filters



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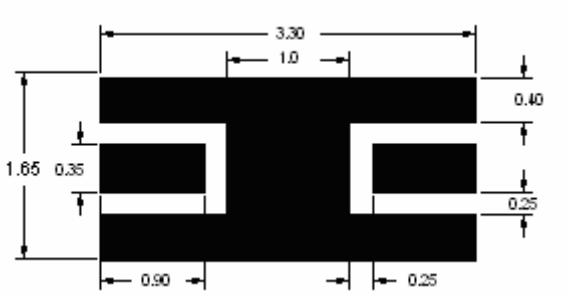

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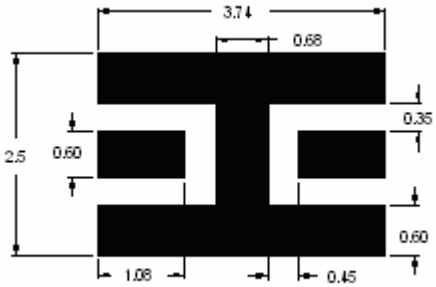

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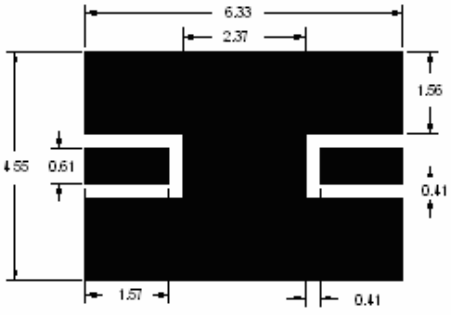

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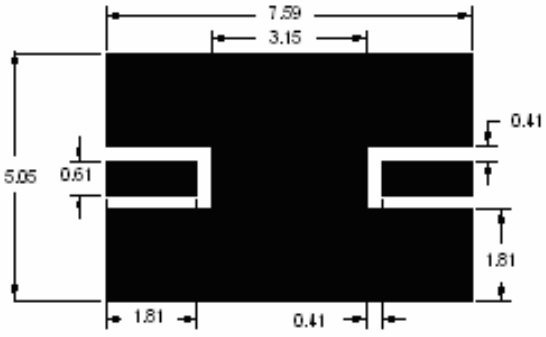

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