

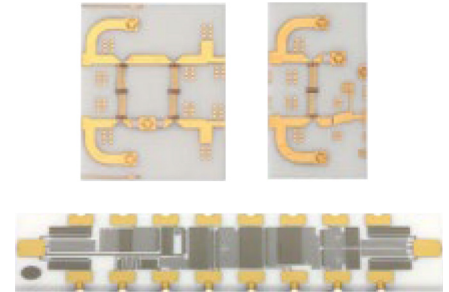


DID YOU KNOW?

COST REDUCTION STRATEGIES FOR THIN FILM SUBSTRATES

Custom Thin Film Substrates (SPF1 / SPF2 / PSS / INT / SDWP)

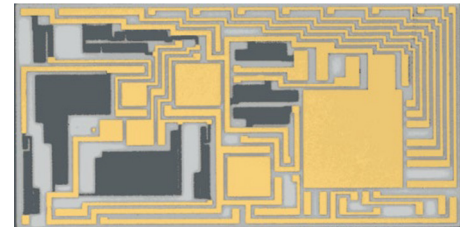
Vishay Electro-Films (EFI) manufactures thin film custom substrates that aid in several different applications – such as hybrid circuits and RF / microwave designs in a wide range of industries, including military, aerospace, medical, industrial, and telecommunications. When designing custom substrates, many customers are looking for ways to reduce the cost of their thin film products. There are many capabilities Vishay EFI offers with distinct advantages – including Au-filled vias, AuSn sputter deposition, and side-wall patterning – that add cost when manufacturing. Here are some elements to think about when designing custom substrates.



Substrate Size

The major cost driver when designing custom substrates is the size of the part. This is because:

- The substrate size determines the number of parts that can fit on one plate during manufacturing
- The larger the part, the more manufacturing processing time and raw materials are required to fulfill a larger order
- When ordering small parts (< 0.050 in. x 0.050 in.), it is better to order a larger quantity of pieces because the processing for one substrate costs the same, whether you buy one piece or 1000 pieces

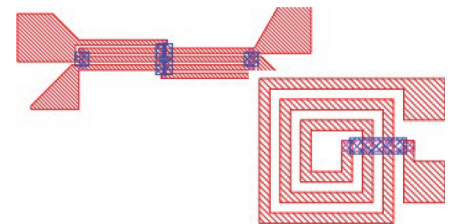


For more information on substrate sizes that Vishay EFI offers, see the datasheet [SPF1](#).

Feature Density

Another major cost driver for thin film custom substrates is line width and spaces for metal traces. These metal traces are typically either sputtered or plated metal that are photopatterned or etched back using different photolithography methods. This is a cost driver because:

- The smaller the metal pattern linewidth and spaces, the more challenging it is to manufacture the part, and therefore lower yields result
- The more features designed on a part, the higher potential for defects during the manufacturing process and the lower the yield

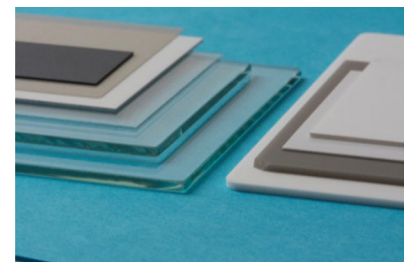


For more information on feature densities that Vishay EFI offers, see the datasheet [SPF2](#).

Substrate / Surface Finish

Another cost driver that affects custom substrate design is the type of substrate utilized. There are many different reasons why a certain substrate is chosen, including requirements like high power, thermal management, low CTE, surface finish, and dielectric constants. Cost-driving features are:

- Specialty plates like quartz, titanates, ferrites, and sapphire
- Surface finish: polished, as-fired, or lapped
- Substrate thickness



For more information on substrate types and surface finishes that Vishay EFI offers, see the datasheet [SPF1](#).



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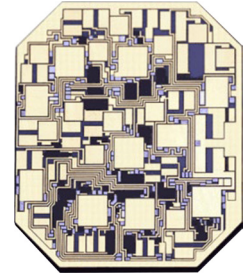
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Metal Layers

Different metal stacks are used for different applications; for example, a chrome / copper / nickel / gold layering is a good metal stack for high power applications. The various metal options we offer can add cost depending on the requirements, like:

- Multiple metal stacks on one substrate, including AuSn
- Desired metal thicknesses
- Price of metal

For more information on standard metal stacks that Vishay EFI offers, see the datasheet [SPF1](#).



Au-Filled Vias

Au-filled vias are another capability that is a cost driver when designing custom substrates. Au-filled vias are used in substrates to conduct the heat out of the substrate, improve electrical performance, and provide an electrical connection from the top to the bottom of the substrate. Cost drivers of vias include:

- Price of Au metal (solid Au is used in Vishay EFI's process)
- Number of vias on one substrate



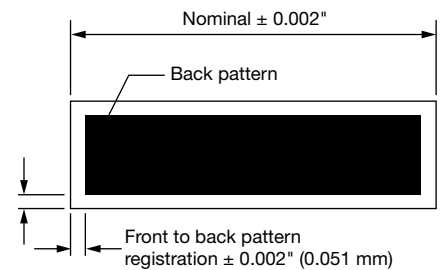
For more information on Au-filled vias, see the technical note [Applications and Design Guidelines of Plated and Filled Via Circuits](#).

Dimensional Tolerances

Dimensional tolerances are important aspects of a custom substrate design. The tighter the dimensional tolerances, the more expensive the substrate will end up being. Some of the critical dimensions considered are:

- Overall part dimensions
- Front pattern to back pattern tolerance
- Metal pattern pullback from edge of the die

For more information on dimensional tolerances that Vishay EFI offers, see the datasheet [SPF2](#).



Part Family	Description
SPF1	Metallized plates / bare ceramics
SPF2	Conductor pattern / AuSn
PSS	Resistor / conductor pattern
INT	Metal via / multilayer / lumped element / edge wrap
SDWP	Sidewall pattern

Being aware of the Vishay Design Guidelines when designing your substrate will help ensure manufacturability and lower costs. You can access the Design Guidelines [here](#).