

RapiTrim Solutions

RF and Microwave Components

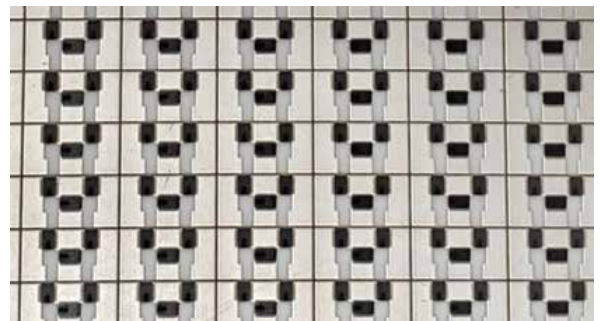
The RapiTrim family of resistor trimming systems can be delivered in a variety of configurations suited to different applications. The flying probe version is ideally suited to high-mix, quick-turn production. The probe card version is more appropriate for high volume production with infrequent job changes. While both system configurations can be of use in the manufacture of RF and microwave components, custom solutions also play a role.

The field of RF and microwave components encompasses a wide variety of devices with a wide variety of uses in telecommunications, medical instrumentation, defense and aerospace applications. Typical devices are attenuators (pi and T), power splitters, couplers, divider / combiners, terminations, resistor divider networks, hermetic packages needing active trim, etc. These can be fabricated with standard thick-film pastes on alumina and aluminum nitride substrates, or thin films on similar and silicon substrates, with the choice dependent on the functionality and tolerance required, as well as the cost. Importantly, new complex resistor trim geometries are easily addressed with the RapiTrim system.

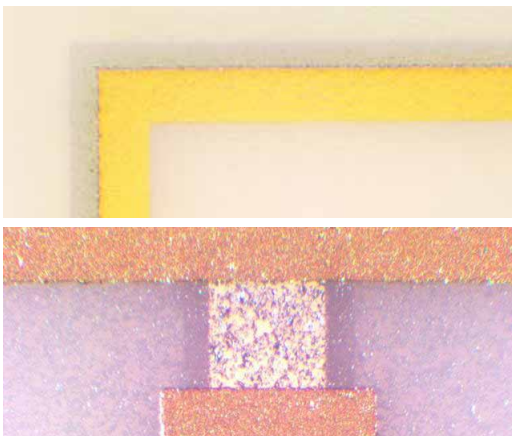
Substrate Layout

As with most components for standard DC trimming, devices are manufactured in arrays on substrates usually ranging in size from 50x50mm (2x2") up to 100x100mm or larger. Depending on the functionality, devices can vary from less than 1mm in size to 10mm or more.

There are also circuits in packages that will get actively trimmed (circuit output characteristics are monitored by external instruments while trimming a resistor in the circuit) prior to hermetic sealing.



Array of thick film attenuators on an alumina substrate.



Examples of a corner shave trim using a green laser (top) and a symmetric shave trim using a small IR spot (bottom), both on thin film resistors.

Laser and Beam Delivery

The choice of laser wavelength and spot size will depend on the resistor material, desired kerf width, target tolerance and required depth of field to accommodate variations in height of the resistor locations. Given the range of device types, resistor materials and substrates involved, the whole range of laser wavelengths and spot sizes can be considered. Thick film resistors (usually on alumina or FR4 substrates) are trimmed with the IR wavelength (1.06 μ m) and a spot size >25 μ m.

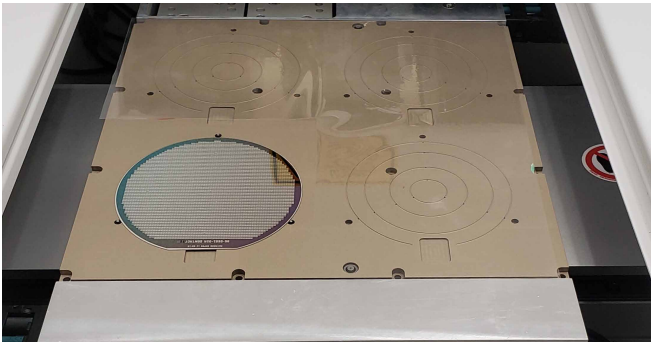
Thin film resistors can also be trimmed with similar spot sizes however smaller resistor geometries and tighter final tolerances often require spot sizes to 10 μ m or less.

The green wavelength (around 532nm) is used to generate small (10 μ m) spots for thin film trimming while providing a larger working Z range than the 1.06 μ m laser for the same spot size.

Part fixturing.

All fixturing options discussed in other notes are available here as well, although most requirements will be handled by the standard vacuum chuck top or multi-up version since several substrates can fit within the 300x300mm process area. Round silicon wafers can also be processed on a custom fixture plate (e.g. a 4-up arrangement of 4-inch wafers) and manual load.

PPI's universal active trim interface is adaptable to most active trim requirements. Standard sockets can be integrated by PPI, or unique sockets provided by the customer.

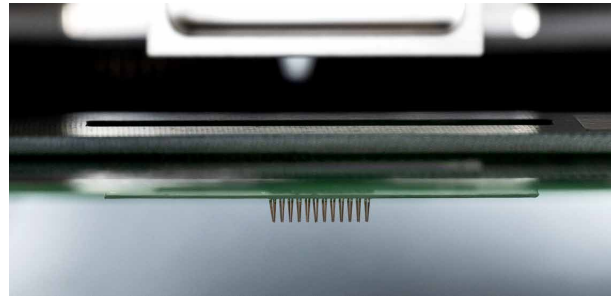


4-up fixture plate for 4-inch diameter silicon wafers.

Probing and measurement options.

As noted with fixturing, probing can employ any technique depending on the application. High volume production is usually accomplished with probe cards, especially if there are simple component layouts that allow trimming in a single probe card pass. If there is a high mix of smaller job lots, then flying probes will likely provide higher production efficiency. In all cases guard probing and Kelvin probing are available.

Active trimming can employ either probe cards or flying probes, or specific test sockets with signals routed through the switch matrix to external instruments as required.



Probe card with a set of Kelvin probe needles for simultaneous contact with several DUTs.



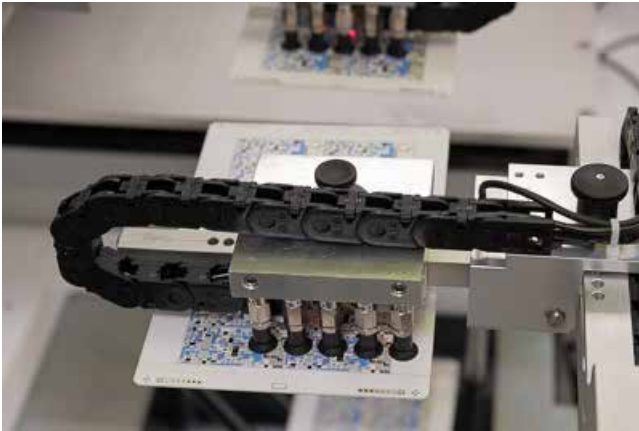
9-up fixture plate for locating 50x50mm substrates. Different fixtures can be exchanged in seconds.



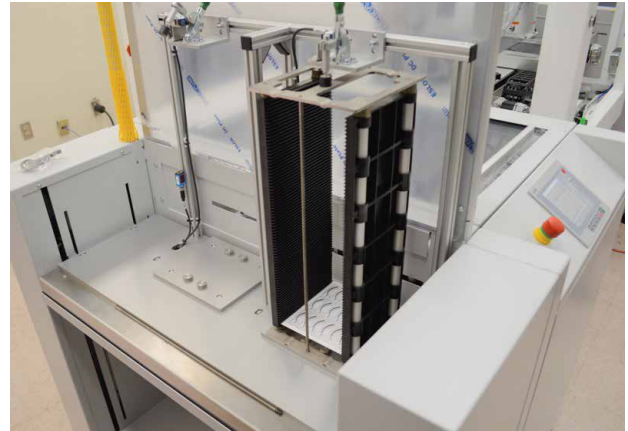
Hybrid package loaded into PPI's universal test fixture with customer-specific test socket for active trimming.

Automation options.

The automation will be chosen to best suit the application, ranging from manual load of plates onto the vacuum chuck in a single or multi-up arrangement, to PPI's internal stack loader, or to magazine / robotic loading for high volume production. Loading for active trim requirements usually involves manual loading into a fixture / test socket.



Thick film circuit substrate held by vacuum pickup head in PPI's internal stack loader.



40-piece magazine for autoloading of substrates that can't be stacked.

Job creation.

A DXF is useful for importing all the geometry related to the DUT and substrate. For the active trim scenario there is typically a multi-step procedure required, and a script is written to handle this aspect of the trim and test process. The script can involve conditional processing (if-then-else...), looping, and control of additional measurement instruments, among other tasks. Execution of any of these processes is performed seamlessly within the RapiTrim job without the need for operator intervention.

PPI has your solution for
RF and microwave components.

RapiTrim

The Future of Resistor Trimming™

