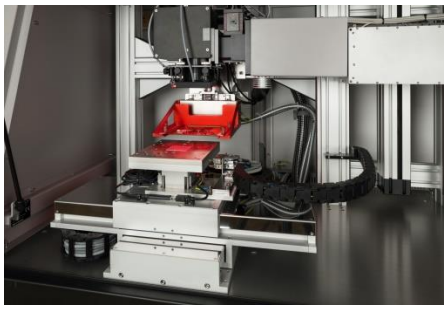
LASER TRIMMING BASICS

ADVANCED TECHNOLOGY FOR RESEARCH & INDUSTRY

KNOWLEDGE BASE FACT SHEET

- SCOPE: What is laser trimming and how does it work?

Laser trimming is the manufacturing process of using a laser to adjust the operating parameters of an electronic component or circuit by incrementally reducing the amount of component material.



The most common use of laser trimming is to change the resistance of a thick-film or thin-film resistor by burning away a small proportion of the resistive material. This cut, or trim, increases the resistance of the component by narrowing or increasing the current path through the resistive material.

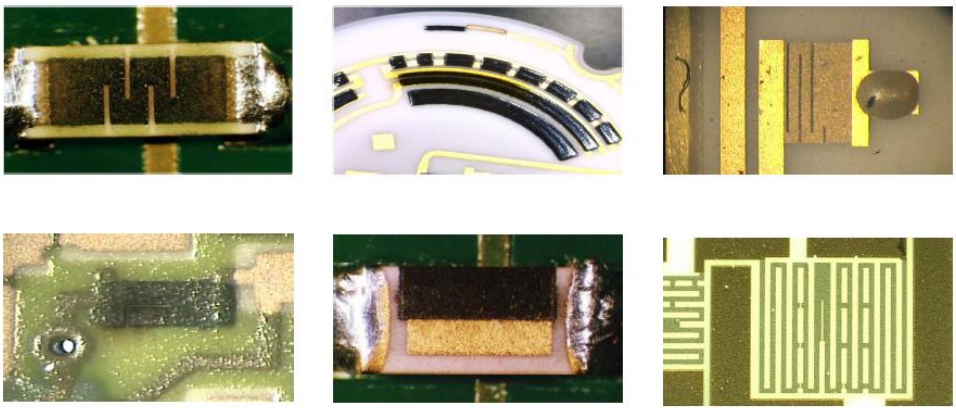
Actively measuring the resistance value of this resistor as the trim is in progress means that this is a very accurate way of determining the final result.

Certain types of capacitors can also be accurately laser trimmed to the correct capacitance. Removing the top layer of a multilayer capacitor decreases the capacitance by reducing the area of the top electrode.

There are two main types of trimming process: **Passive** and **Active**. **Passive** trim is the adjustment of a single component, for example a resistor or capacitor, to a given value. If the trimming alters the whole circuit output such as voltage, frequency or attenuation, then this is called an **Active** trim. During the trim process the circuit output is monitored continuously, shutting off the laser automatically when the desired output is achieved.

Process variability stems from the laser spot size, laser power at the component level, and wavelength / pulse duration of the laser source.

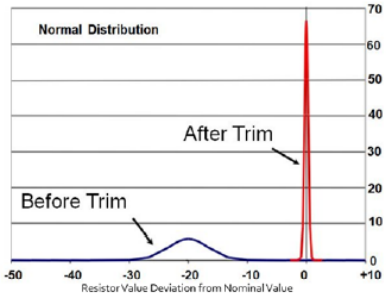
Both passive and active trim require electrical contact to the component circuit for feedback measurement. This is usually achieved via a dedicated probe card utilising spring blades or pressure pins.

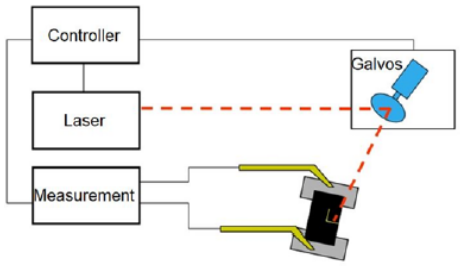


Trim cut examples

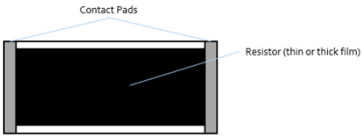
Idea behind Laser Trimming

- Manufacture network circuits with imprecise resistors at relatively low price point
- Adjust resistor values to needed and precise value by use of laser trimming on final circuit

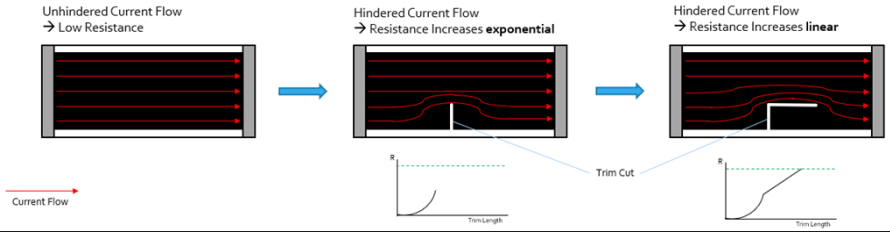




Working Principle Laser Trimming



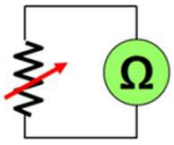
Laser trimming can only increase the value of a resistor while hindering the current flow by cutting into the current flow path



Trim Methods

Passive Trim

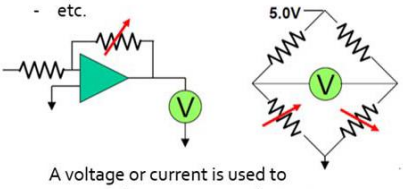
Trimming to a nominal Ohmic value
- absolute Ohms
- ratio of other resistors



A voltage or current is used to measure the value of the resistor

Active Trim

Trimming a live circuit for a desired output
- Volts
- Frequency
- etc.



A voltage or current is used to activate the entire network circuit

Examples for Laser Trim Cuts

Trim Cut Type	Trim Sensitivity	Advantage	Accuracy
P Cut		simple cut very fast	< 0.50 %
D Cut		relative exact fast suitable for small geometries	< 0.20 %
L Cut		relative exact fast	< 0.30 %
M Cut		high change of resistance	< 0.30 %
Shave Cut		trim of chip-capacitors best accuracy lowest current noise	< 0.15 %