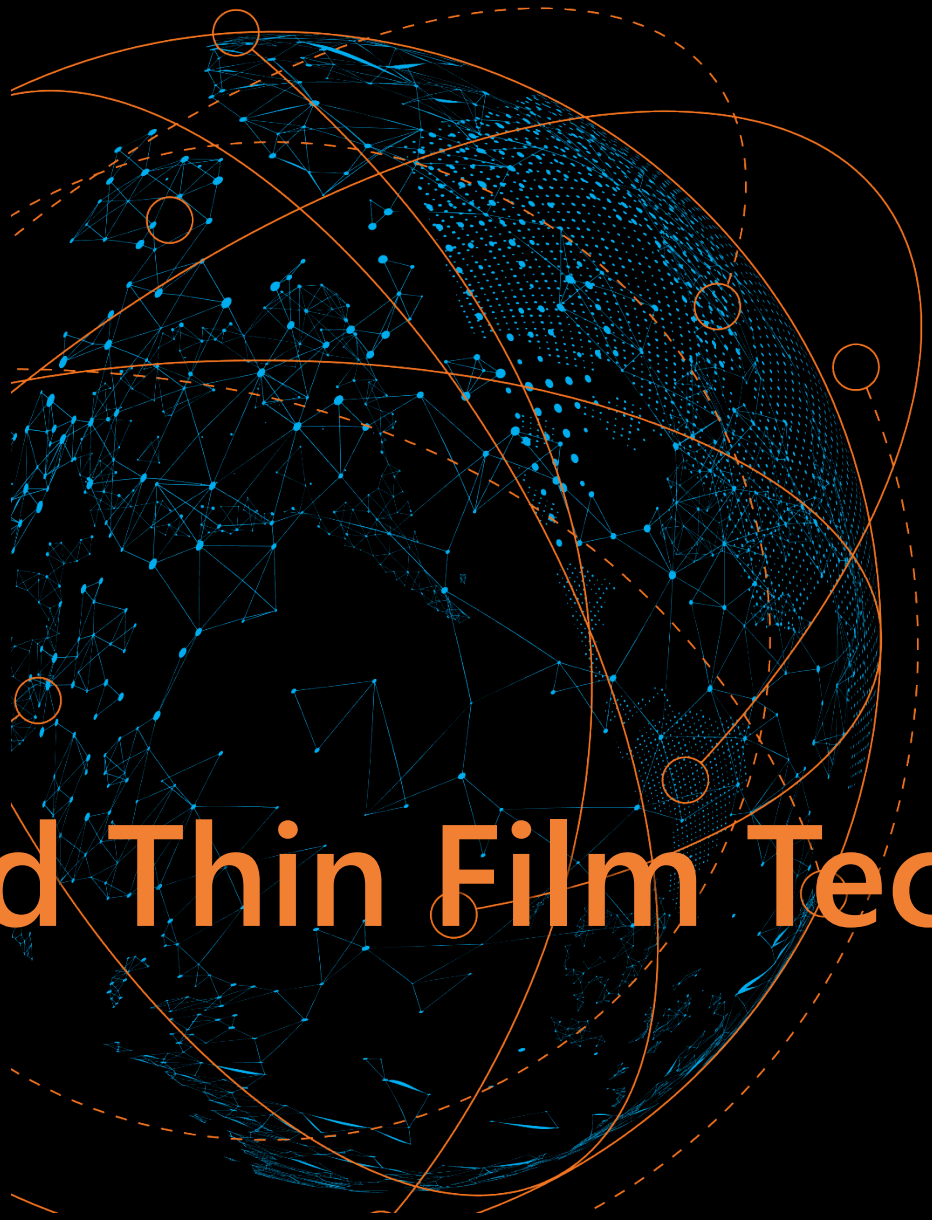
SPECTRUM CONTROL

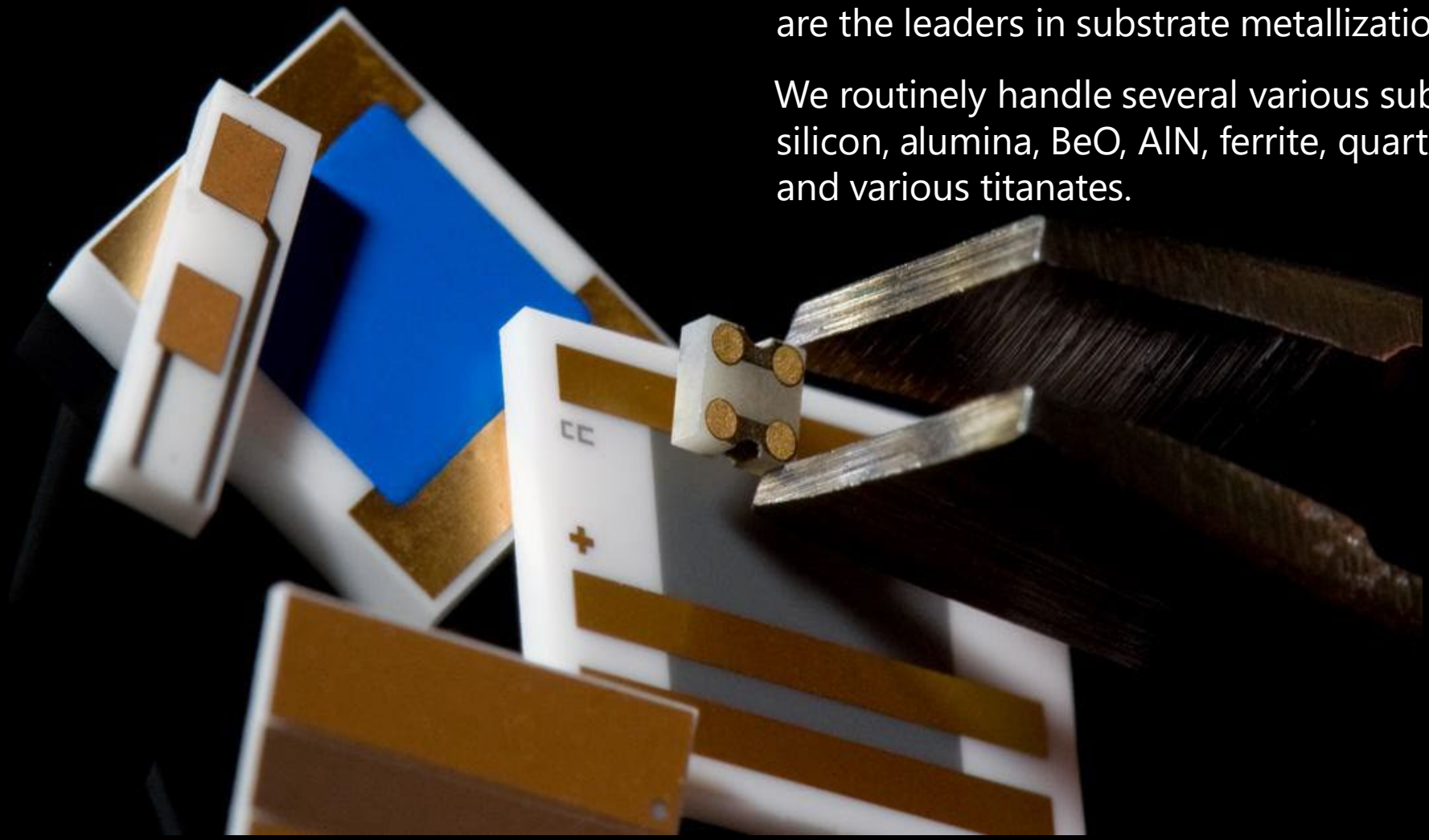


Advanced Thin Film Technologies

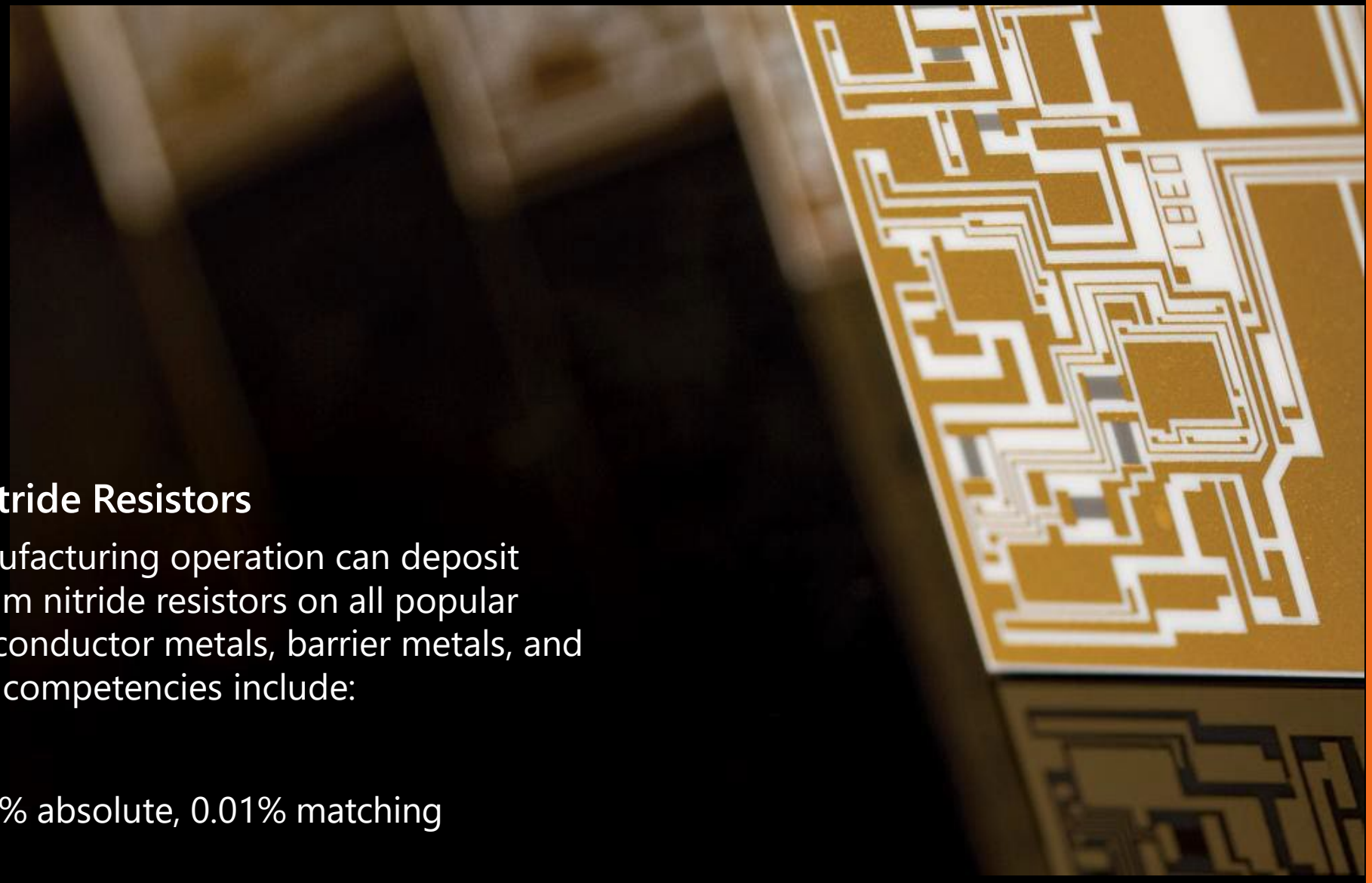
Advanced Thin Film Technologies

Spectrum Control's engineers are experts in the field of metallization. With over 50 years of manufacturing experience, we are the leaders in substrate metallization and process development.

We routinely handle several various substrate materials, including silicon, alumina, BeO, AlN, ferrite, quartz, glass, sapphire, fused silica, and various titanates.



Embedded Resistor Layers

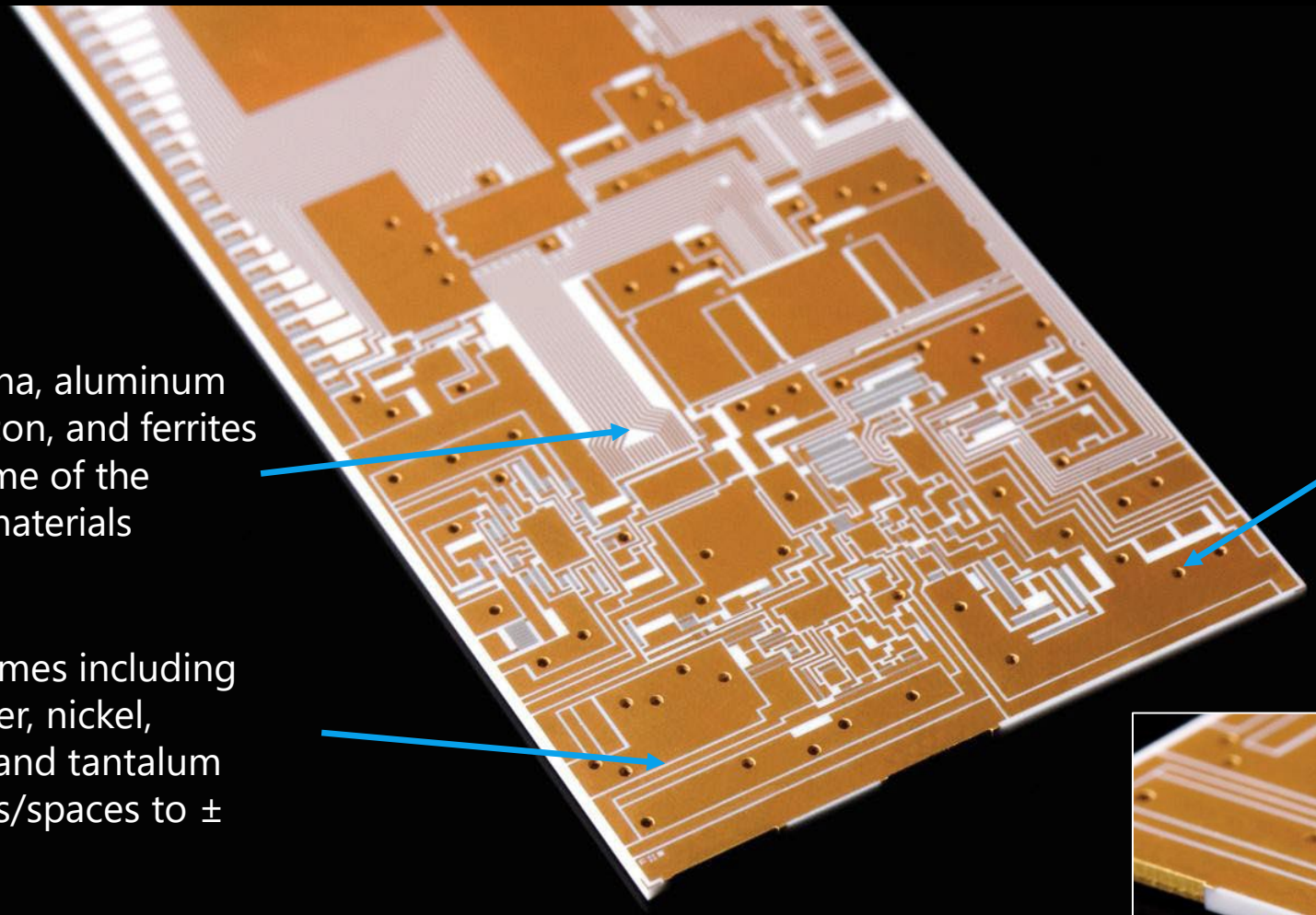


Nichrome/Tantalum Nitride Resistors

Our internal thin film manufacturing operation can deposit either nichrome or tantalum nitride resistors on all popular substrates, utilizing most conductor metals, barrier metals, and base metals. Specific core competencies include:

- Tolerances to **± 0.0001"**
- Resistor tolerance to 0.1% absolute, 0.01% matching

Interconnects

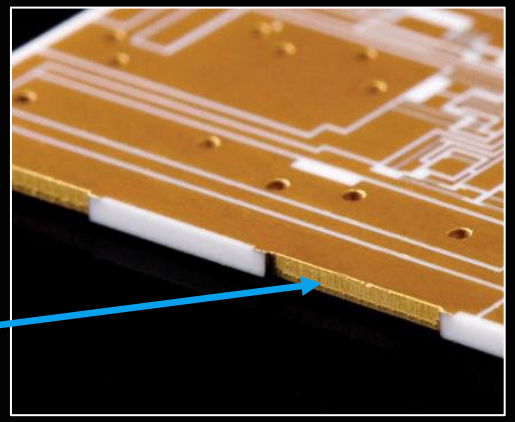


BeO, alumina, aluminum nitride, silicon, and ferrites are just some of the substrate materials available.

Metal schemes including gold, copper, nickel, nichrome, and tantalum nitride lines/spaces to ± 0.0003".

Few companies can provide edge and wrap-around services as we do. Selective 360˚ deposition enables gold to be deposited with a thickness of 100-400 microinches.

Gold-plated or metallized vias for improved ground plane connection or heat dissipation.



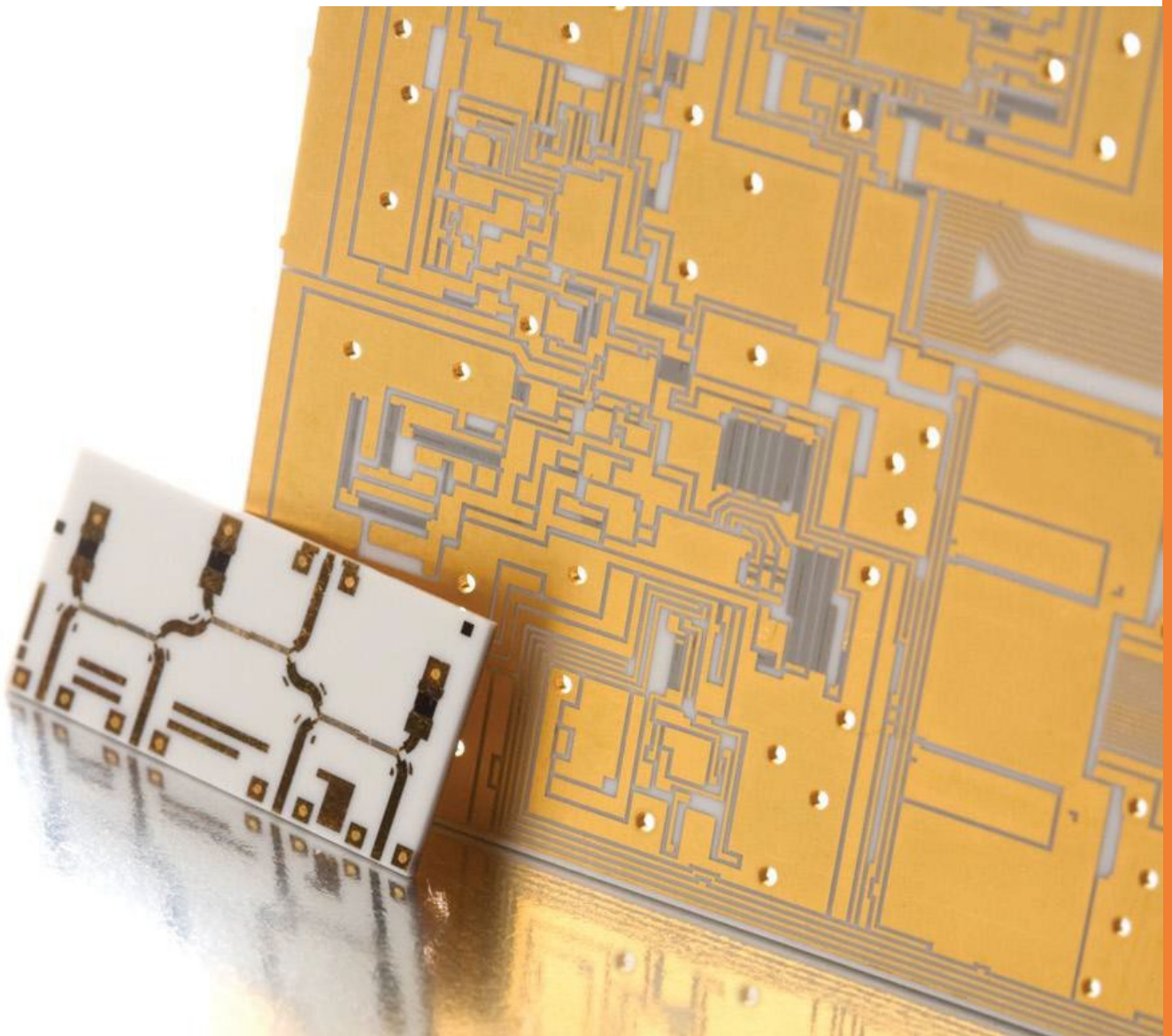
Vias

We offer both filled vias or plated through holes, part of the benefits of the Spectrum Control advantage.

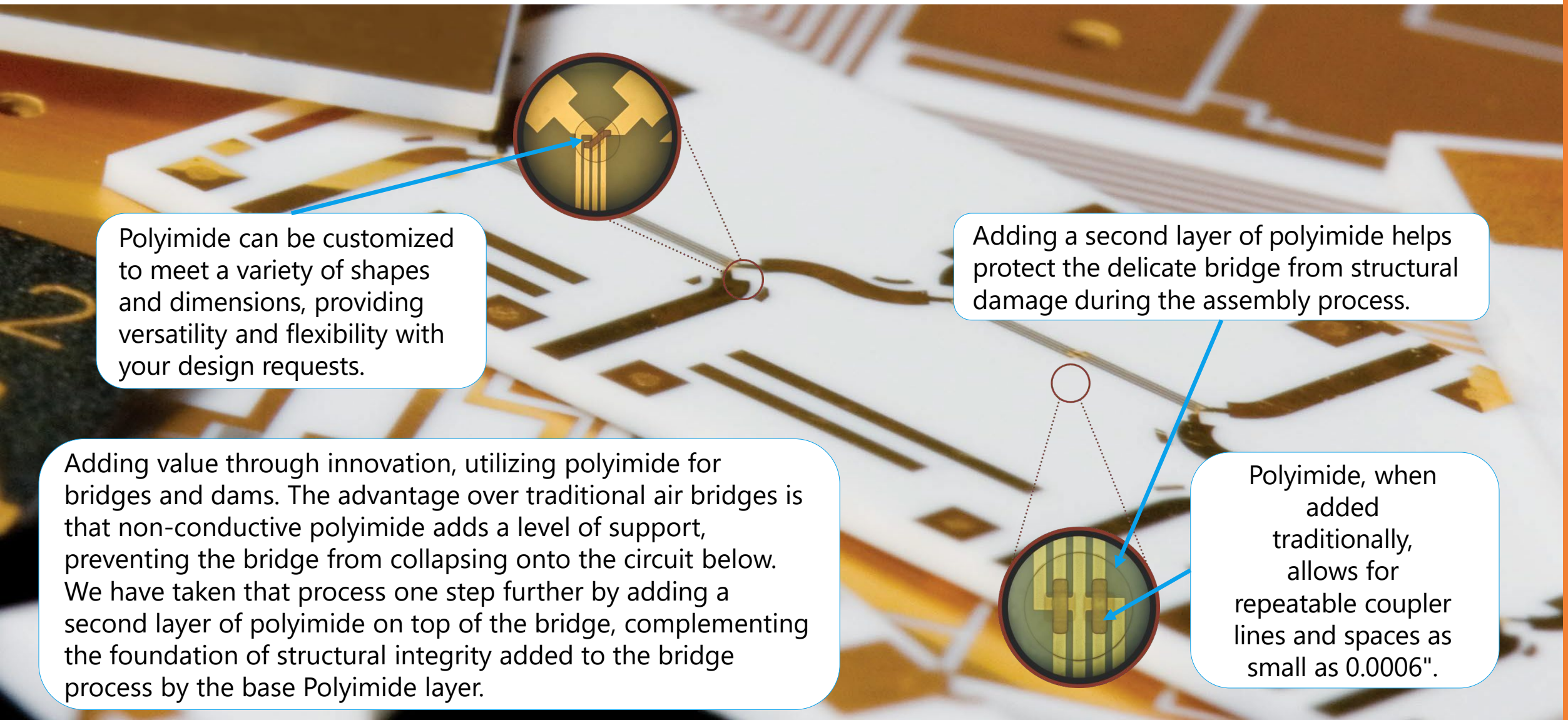
Our in-house laser drilling capabilities allow you, the customer, to eliminate epoxy bonding in the assembly process for improved grounding and thermal conductivity.

Plated Through Vias

Whether drilling on alumina, aluminum nitride, BeO, silica, or quartz, using our advanced laser drilling method ensures enhanced mounting convenience without the need for awkward bonding techniques.



Polyimide Capability



Polyimide can be customized to meet a variety of shapes and dimensions, providing versatility and flexibility with your design requests.

Adding a second layer of polyimide helps protect the delicate bridge from structural damage during the assembly process.

Adding value through innovation, utilizing polyimide for bridges and dams. The advantage over traditional air bridges is that non-conductive polyimide adds a level of support, preventing the bridge from collapsing onto the circuit below. We have taken that process one step further by adding a second layer of polyimide on top of the bridge, complementing the foundation of structural integrity added to the bridge process by the base Polyimide layer.

Polyimide, when added traditionally, allows for repeatable coupler lines and spaces as small as 0.0006".

Metallization

With 5 decades of sputtering experience, we are the premier choice for thin film metallization solutions

Besides standard metals like Gold, nickel, and Titanium Tungsten, we are also specialists in a variety of metallization options, including copper, aluminum, and chromium.

Sputtering Systems

- Sputtering equipment
  - KDF954
  - KDF943
  - MRC954
- Load lock systems
- 12″ x 12″ palette size

- Capacity: 18k 2″ x 2″ substrates/month
- Current operating level: 1k/month
- Process
  - Alkaline cleaning with DI rinse water
  - 12″ x 10″ sweet spot

Photolithography & Etch

- Positive resist
- Wet etching available for Au, TiW, Ta, NiCr, Ni, Cu, Ti, SiO2
- Minimum geometrical etching
  - Conductors: 0.6 mils (0.1 tolerance)
  - Resistors: 0.2 mils (0.04)

Design Guidelines

Thin Film Metallized Substrates

This useful layout guide, with its accompanying metals and their functions outline, will serve as a resource for both the CAD specialists and the engineer involved in the design of the substrate or PC board.

Helpful resistor values along with material types and their range of functions are included, and another example of why we lead the industry in both innovation AND customer service.

Sample Resistor Layout Guide

Parameter	Value Inches (µm)	Comment
Resistor Style Min. Resistor Dim.	Type-1 0.002 x 0.002 (50 x 50)	Resistor inboard of conductor
Min. Probe Pad Dim.	0.003 x 0.003 (75 x 75)	Perpendicular to current flow
Conductor/Resistor Overlap	0.0005 (12.5) per side min. 0.002 (50) per end	Parallel to current flow

Metals and their Functions

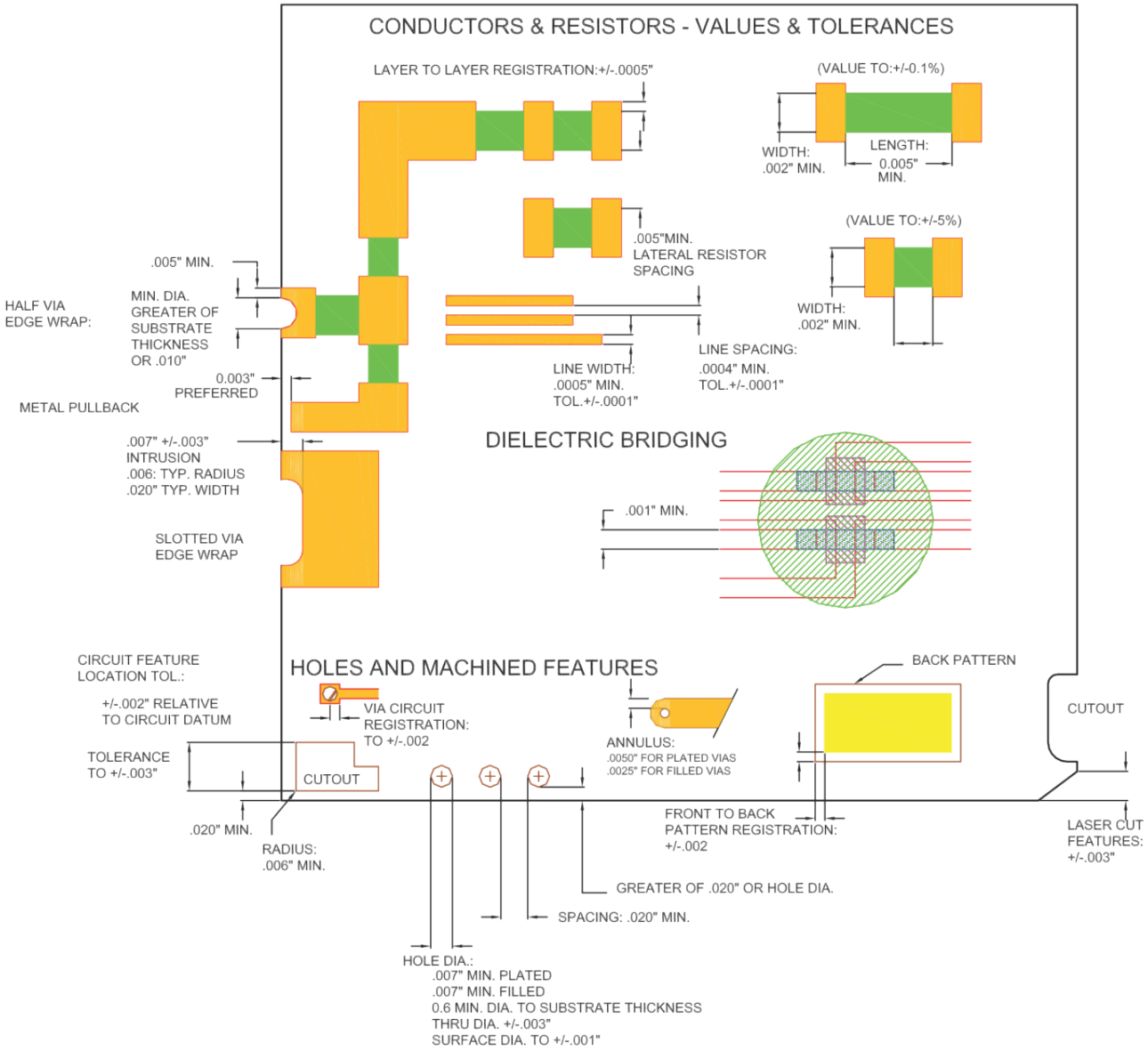
Material Function	Material Type	Range of Functions	Comments
Resistors	Tantalum-Nitride (TaN) Nickel-Chromium (NiCr) Chromium-Silicon (Cr.Si)	10 – 150 Ω/square (min) 20 – 350 Ω/square (min) 500 – 1500 Ω/square	Best for non-hermetic environment Low TCR Small package high-value resistors
Adhesion	Tungsten-Titanium (TiW) Chromium (Cr)	250 – 750 Angstroms 250 – 750 Angstroms	Ideal for high temperatures Low temperature limitation
Barriers	Nickel (Ni) – Sputtered Nickel (Ni) - Plated	750 – 20000 Angstroms 40 - 100µ in. (1 2.5µm)	Standard barrier High conductivity barrier
Conductors	Copper (Cu) Gold (Au)	30 – 500µ in. 10 - 200µ in. (0.25 - 5µm)	High power/solderable Tight tolerance Fine line features available

Layout Guidelines

Values and Tolerances Schematic

Spectrum Control knows that critical attention to artwork dimensions and tolerances is of paramount importance during a design packet transfer.

To assist with this critical step in the design process, we provide an illustration as seen here, which includes suggested values and tolerances that should be followed to facilitate a complete and comprehensive design packet.



Standard Thin Film Chip Resistors

Thin Film Chip Resistors

Spectrum Controls' 68 Series (0.020" x 0.020") thin-film chip resistors, which come in values from 1 ohm to 500 kilohm, offer customers both value and quick delivery, two items that other suppliers are not usually found together. With over 2 million resistors in stock, Spectrum Control can easily fill your order and get you the components you need.

Both passivated nichrome and tantalum-nitride resistor versions are available in both top-contact and back-contact versions in several resistances and tolerances.

Standard Thin Film Chip Resistors

Silicon Chip Resistors: Electrical Specifications

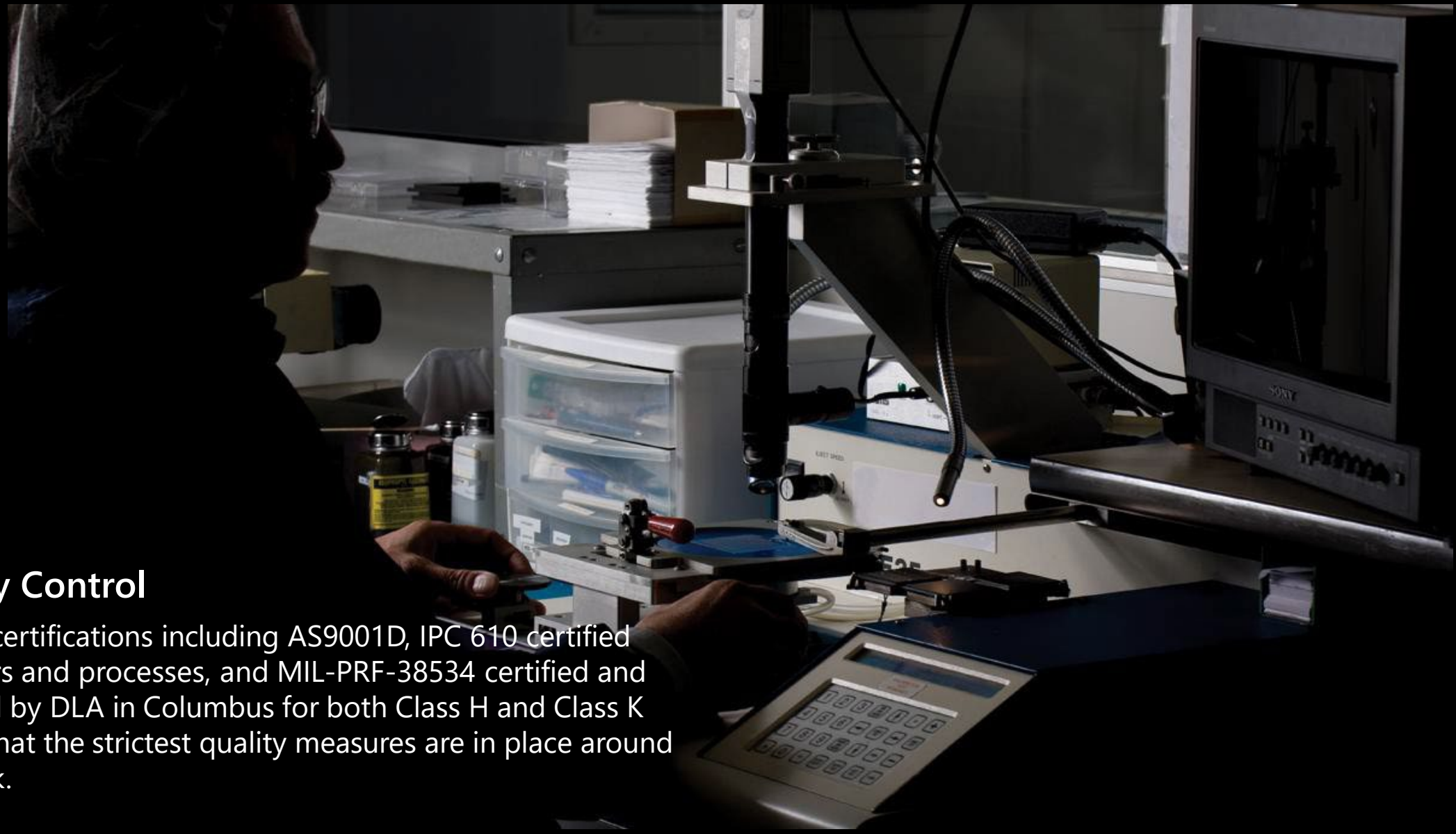
20 x 20

Parameter	Limit	Test Conditions
Power Rating	100 mW	(derated at 70°C to 0 mW @150°C)
Life	± 0.2% max	1000 hours @125°C
Noise	-35 dB typ	MIL-STD-202 Method 308
High Temp Exposure	± 0.2% max	100 hours @ 150°C
TCR (68AL, 68BCN)	0 ± 50 ppm/°C	-55°C to 125°C
TCR (68ALT, 68BCR)	-100 ± 50 ppm/°C	-55°C to 125°C
Operating Voltage	100 VDC max	
Moisture Resistance	±0.5% max	MIL-STD-202 Method 106
Thermal Shock	±0.5% max	MIL-STD-202 Method 107

30 x 30

Parameter	Limit	Test Conditions
Power Rating	200 mW	(derated at 70°C to 0 mW @150°C)
Life	± 0.2% max	1000 hours @125°C
Noise	-35 dB typ	MIL-STD-202 Method 308
High Temp Exposure	± 0.2% max	100 hours @ 150°C
TCR (61AC, 61AL)	0 ± 50 ppm/°C	-55°C to 125°C
TCR (61ACT)	-100 ± 50 ppm/°C	-55°C to 125°C
Operating Voltage	100 VDC max	
Moisture Resistance	±0.5% max	MIL-STD-202 Method 106
Thermal Shock	±0.5% max	MIL-STD-202 Method 107

Quality Standards



Quality Control

Quality certifications including AS9001D, IPC 610 certified operators and processes, and MIL-PRF-38534 certified and qualified by DLA in Columbus for both Class H and Class K ensure that the strictest quality measures are in place around the clock.