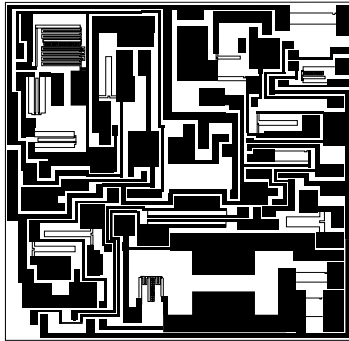


Patterned Substrates



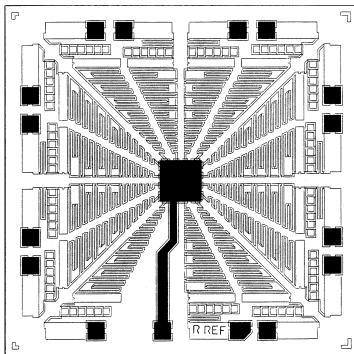
FEATURES

- Sizes to 0.5 inches square.
- Substrates 99.6% alumina 15 or 25 mils thick.
- Front and backside metallization.
- Selectively metallized wraparound edges and through holes.
- Conductors are gold or nickel/gold.
- Polyamide passivation where specified on resistors and conductors.
- Element evaluation per MIL-PRF-38534, Table VII Class H.

Patterned thin film substrates are resistor/conductor or conductor only patterns which are used as conventional hybrid or microwave circuits. They may be designed for soldered on components or chip-and-wire assembly. Resistors may be factory trimmed or user trimmable.

Vishay can use your artwork if it meets our specifications or we can generate artwork from your CAD file or drawings. These substrates frequently contain critical dimensions or shapes which must be specified and discussed with the Vishay Engineering Department.

Networks



Precision chip resistor networks are produced on fine-grain alumina or silicon substrates using a unique tantalum composite film which has an absolute temperature coefficient of resistivity less than + 20ppm/°C. These miniature arrays are finding increased use in hybrid micro-circuit where space conservation, low TCR, close tracking, tight tolerance, exceptional stability or pretesting are required. Parts handling and wire bonding are significantly reduced versus individual chip resistors. Tracking of resistors over temperature within a given network is well within 2ppm/°C. Overall design tolerances can be maintained, if required, to within + 0.025% under a wide range of conditions including circuit assembly and extended high temperature operation.

Manufacturing is performed under rigid process control by a team of specialists having many years' experience in the design, fabrication, automatic laser trimming and testing of hundreds of different precision thin film resistor networks.

FEATURES

- Alumina substrates because of their outstanding thermo-mechanical properties and high-frequency behavior.
- Superior film adhesion.
- A composite resistor film with very low TCR.
- Gold termination pads for reliable thermocompression wire bonding and metallurgical stability.
- Stability of better than 300ppm/1,000 hrs at 125°C absolute or 30 ppm relative.
- Exceptional power-handling capability.
- Ideal for functional trimming.
- Documentation and calibration are an inherent part of the quality control system.
- 100% visual examination to MIL-STD-883, Method 2032 Class H.

TYPICAL PERFORMANCE

	ABS	TRACKING
TCR	25	5
	ABS	RATIO
TOL	1.0%	0.1%

STANDARD ELECTRICAL SPECIFICATIONS

TEST	SPECIFICATIONS	CONDITIONS
PART	CUSTOM NETWORKS	
TCR: Tracking	$\pm 5\text{ppm}/^{\circ}\text{C}$	- 55°C to + 125°C
Absolute	$\pm 25\text{ppm}/^{\circ}\text{C}$	- 55°C to + 125°C
Tolerance: Ratio	$\pm 0.5\%$ to $\pm 0.05\%$	+ 25°C
Absolute	$\pm 1\%$ to $\pm 0.1\%$	+ 25°C
Power Rating: Resistor	100mW	Max. at + 70°C
Package	Size dependent	
Stability: ΔR Ratio	0.05%	2000 hrs. @ + 70°C
Voltage Coefficient	5ppm/Volt	
Working Voltage	100 Volts	
Operating Temperature Range	- 55°C to + 125°C	
Storage Temperature Range	- 55°C to + 150°C	
Noise	< - 35dB	
Shelf Life Stability	100ppm	1 Year @ + 25°C

MATERIALS

Substrate	The device substrate shall be either 99.6% Alumina 0.015" + 0.002" or 0.025" -+ 0.002" or Silicon 0.014" +0.002".
Metallization (Front and back sides if required.)	Gold - 75 to 150 Micro Inches Nickel - 30 to 70 Micro Inches
Masks	All masks are 5' x 5" x 0.090" Max. glass masks with Chrome on the bottom (right reading). Products that will require repeat orders will require a master of each mask, or a source of supply for the copy plates.

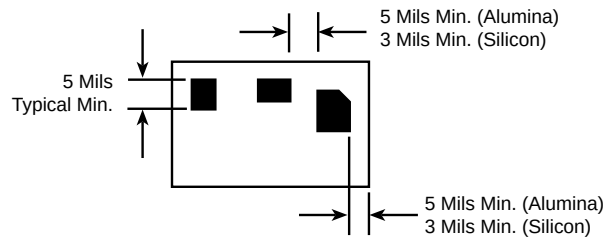
Vishay uses three masks in the production of parts. The following is a description of each:

Conductor Negative (C)	The bond pads and conductors shall be clear; all other areas shall be opaque (clear geometry dark field).
Resistor (R)	All geometries, both resistor and conductor shall be opaque, all other areas are clear (dark geometry clear field).
Passivation (P)	All bond pads, separation borders, user trim openings or other required areas shall be clear (clear geometry dark field); all other areas shall be opaque.
Mask Data	Vishay uses Autocad running on a Windows environment. Data that can be converted into Autocad can be used and edited by Vishay. For more information contact Vishay.



MECHANICAL DESIGN	
Chip Network Size	0.020" x 0.20" to 0.5" x 0.5"
Border	The border from pads or resistors to edge of die, shall be 5 mils minimum for alumina substrates and 3 mils for silicon.
Step and Repeat	Size to be in increments of 0.005" (minimum size 0.020").
Pads and Conductors	Wire-Bond

RESISTOR NETWORK



Wire bond pad locations will be per the individual specifications.

Pad 1 shall be identified with the pad as a circle, oval or angled at the corner.

The wire bond pads shall be no less than 5 mils by 5 mils, with spaces between pads no less than 3 mils.

A resistive border of no less than 0.1 mil and no greater than 2 mils shall be around each pad.

Conductor pads shall be as short as possible. Whenever the length is excessive or the resistor value is low, the T.C.R. shall be calculated.

Line Width Limits

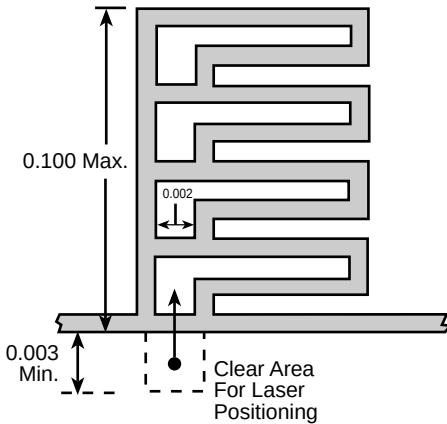
Silicon no less than 0.3 mil, typical 0.5 mil.

Alumina no less than 0.5 mil, typical 1 mil.

Laser Trim Criteria

VISHAY uses ESI model 44 laser trimmers with a beam width size of 0.7 mils and a laser increment of 0.1 mil. Laser beam positioning is no greater than 2 mils.

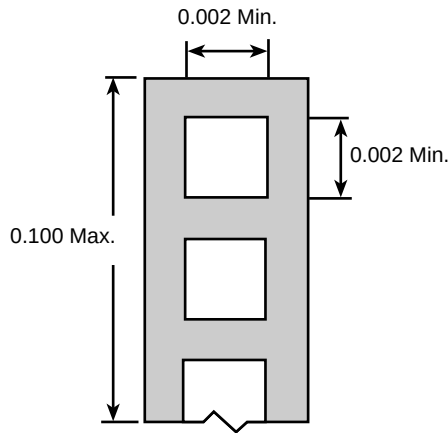
SHUNTS



Shunt trim lengths shall be no greater than 100 mils. The trim opening shall be greater than or equal to 2 mils by 2 mils. (See figure at left)

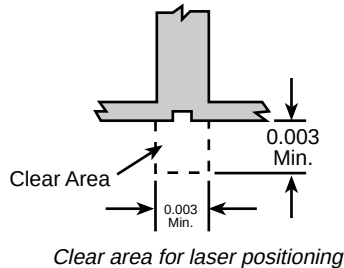
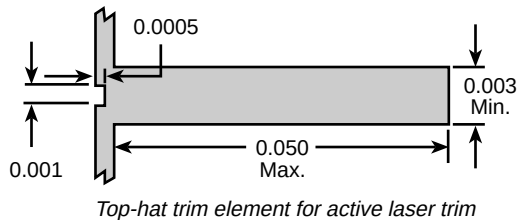
NOTE: Length not to scale. More links may be used than shown.

LADDERS



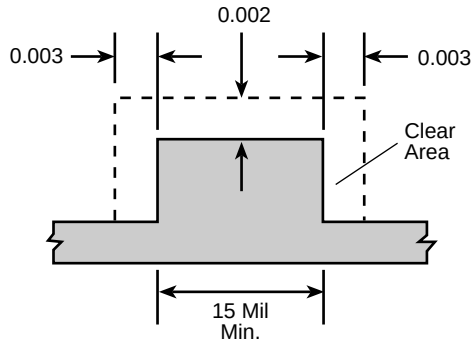
Ladder trim lengths shall be no greater than 100 mils. The trim opening shall be greater than or equal to 2 mils by 2 mils.

TOP HATS



No less than 3 mils wide and no longer than 50 mils.

MECHANICAL DESIGN CONTINUED



Laser positioning clearance for fine trim tabs for active laser trim.

Fine Trim Bars

Greater than 15 mils long (See figure at left).

Parallel Fine Trims

Parallel fine trims shall meet the chip resistor network design requirements.

ELECTRICAL DESIGN

Power Density	The resistors shall be designed with a power density of 50 watts per square inch. Higher densities will be allowed for shorter time periods or if long term stabilities are loose.		
Voltage Gradient	The power density of 50 watts per square inch represents an electric field within the 100 ohms per square film of 70 volts per inch.		
Current Density	The power density of 50 watts per square inch corresponds to a current flux of 2.3 amps/mil square.		
Film Types	SHEET RESISTIVITY (OHMS/SQ.)	DESIGN RANGE	FILM TYPE
	50	35 - 65	Tamelox [®] , Ta ₂ N
	125	88 - 156	Tamelox [®] , Ta ₂ N
	250	188 - 312	Tamelox [®]
Metallization Resistivity	0.0064 ohms per square to 0.01281 ohms per square		
T.C.R.	Gold conductors in series with the resistors add 0.01 ohms per square and a T.C.R. of 3400 per degree C.		

L.W. Limits

Limits shall be determined by the chip resistor network design requirements.
Design Tolerances

All resistor trim geometries will be designed with a total percent change large enough to support the film ranges. The percent tolerance of a coarse trim geometry shall always be 1.5 times less than the total percent change of the fine trim geometry.

SHEET RESISTANCE RANGE	< TOTAL CHANGE OF GEOMETRY
Shunts	< percent change of ladders or final required tolerances.
Ladders	< percent change of top hats or final required tolerances.
Top hats	< percent change of fine trim or final required tolerances.
Fine Trim Bars	< percent change of parallel fine trim or final required tolerances.
Parallel Fine Trim	< percent change of required tolerances.

User Trimmable Resistors All related trim, percent change and tolerance information shall be supplied to Vishay.

User Trim Form

Vishay Thin Film



REQUIRED INFORMATION TO DESIGN USER TRIMMABLE PARTS

CUSTOMER NAME AND PART #: _____

TYPE OF LASER: _____

LASER WIDTH (MILS): _____

LASER INCREMENT: _____ (DISTANCE MOVED PER PULSE) (MILS)

COMMENTS: (Alignment accuracies, visual requirements etc.)

VISHAY'S AS DELIVERED RANGES			CUSTOMER'S REQUIRED RANGES		COMMENTS
P#	R#	NOMINALS	TOLERANCES	TRIM RANGE	RESOLUTION

HYBRID