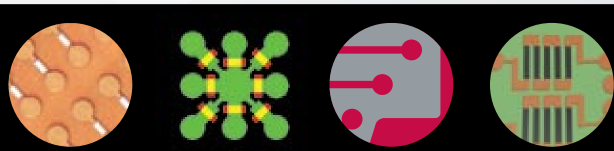
TICER™ TECHNOLOGIES

TCR®

Next Generation Integrated Thin Film Resistor



- **Integrated thin film resistor benefits**
  - Increases active component density and reduces form factors.
  - Improves signal routing through elimination of SMT vias.
  - Improves reliability through elimination of solder joints.
  - Shortens cycle times in PCB assembly.
- **High speed bus design benefits**
  - Improves line impedance matching.
  - Shortens signal paths and reduces series inductance.
  - Eliminates inductive reactance associated with SMT passive devices.
  - Reduces EMI, crosstalk and noise.
- **Resistor stability during thermal excursion**
  - Low temperature coefficient of resistance.
  - Improves resistor tolerance.
  - Long term performance and reliability.
- **Utilizes existing PCB processes.**
- **Uniform isotropic material properties.**
- **Better than ±10% resistor tolerances demonstrated after fabrication.**
- **Laser trimmable to tolerances ±1%.**
- **Capacity in place to meet volume needs.**

OVERVIEW

TCR® thin film resistor foil was developed to meet the ever increasing challenges of packaging high speed, high density electronic devices. Integrating passive components into the circuit board using TCR foil can quickly and reliably improve electrical performance and give designers the edge they need. The TCR technology combines well characterized materials from the semiconductor industry with established copper foils and proprietary vacuum metallization technologies to provide a robust solution for both designers and printed circuit manufacturers.

TCR is offered with enhanced bonding properties, for all resin systems, with a resistive material applied to the matte side of shiny or Doubletreat (DT) using roll-to-roll vacuum deposition technology. The resistive material layer is uniform in composition and deposition thickness ensuring consistent results. Sheet resistance is isotropic and its variation within a roll and between rolls is less than ±5% for most resistance values. The resistive layer is a true thin film with thicknesses from 0.01 to 0.1 μm.

The Grade 3 foil used for TCR is the foil of choice for this application. Grade 3 copper foil exhibits excellent ductility at elevated temperatures, and like standard Grade 3 foils, withstands stresses near the edge of the plated through holes without cracking. These characteristics minimize the need for thermal and mechanical isolation in embedded resistor designs.

TCR foils are commercially available today through Ticer's manufacturing location in Chandler, Arizona. Tests by major PCB companies demonstrate consistent and reliable performance. Toolsets, including design guidelines, a resistor calculator and processing guidelines, are available to designers and fabricators via the Ticer web site.

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Requests for information can be sent to INFO@TICERTECHNOLOGIES.COM. Learn more at www.TICERTECHNOLOGIES.com

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ADVANTAGES

Versatility – TCR is offered in versions suitable for use on a wide variety of resin systems. TCR is optimized to achieve maximum performance when used with standard, high-performance, lead-free and specialty resins systems.

Greater Uniformity – Thickness of the resistive layer is precisely controlled utilizing a proven vacuum metallization process. Precision vacuum metallization targets ensure uniform ratios of the elements in the deposited alloy, resulting in minimal resistance variation. The resistance is isotropic and is not dependent on the machine or grain direction of the copper foil or resistive layer.

Product Performance and Predictability – Ticer Technologies has gone to great lengths to profile the change in resistance of TCR foil during lamination. The changes pertaining to specific laminate materials and lamination conditions are well understood. This predictability ensures the product provided to our customers is consistent lot-to-lot and sheet-to-sheet.

Better Resistor Tolerances – Final etch tolerances benefit from TCR's thin and uniform resistive layer. TCR can eliminate laser trim requirements in all but the most precisely toleranced resistors.

Reduces Fabrication Steps – TCR with Nickel Chromium (NiCr) resistor alloy reduces fabrication steps by eliminating the need for a separate resistive layer etch. TCR can be etched first in cupric chloride followed by ammoniacal etchant. Use of Doubletreat copper eliminates the need for laminate precleaners and oxide treatments.

Excellent Thermal Stability – NiCr, Nickel Chromium Aluminum Silicon (NCAS), and Chromium Silicon Monoxide (CrSiO) are well known for their excellent thermal stability under continuous load and thermal excursion. The materials can be subjected to multiple thermal excursions, such as lead free reflow, with minimal resistance change and ensured long term reliability. The thermal stability of all TCR resistor alloys makes them the choice for designers and users with exacting thermal stability requirements.

SPECIFICATIONS

TCR Integrated Thin Film Resistor Foil is supplied in a variety of foil widths and thicknesses using Grade 3 copper foil. Thicknesses of 18 µm (0.5 oz) and 35 µm (1 oz) are commonly available.

TCR Specification Data Set: Resistive Foil Specifications

Resistive material	NiCr	NCAS	CrSiO
Sheet resistance (Ω/sq)	25, 50, 100	25, 50, 100, 250	1000
Sheet resistivity tolerance (%)	±5	±5	±7
Temperature coefficient of resistance (ppm/°C)	<110	-20	-300
Base copper foil thickness (microns)	18, 35	18, 35	18, 35
Width maximum mm (inches)	1295 (51)	1295 (51)	1295 (51)
Maximum recommended power dissipation at 40° C (watts/sq in)	25 Ω/sq: 250 50 Ω/sq: 200 100 Ω/sq: 150 —	25 Ω/sq: 250 50 Ω/sq: 200 100 Ω/sq: 150 250 Ω/sq: 75	1000 Ω/sq: 250
Recommended etching solutions			
1st etch	Cupric chloride	Ammoniacal*	Ammoniacal*
2nd etch	Ammoniacal	Acidic permanganate	Alkaline permanganate
3rd etch	—	Ammoniacal*	Ammoniacal*

For base foil properties, please refer to the appropriate product application sheet.
** For NCAS and CrSiO, cupric chloride can be used in place of ammoniacal etchant.*