DATA SHEET

Microwave Substrates

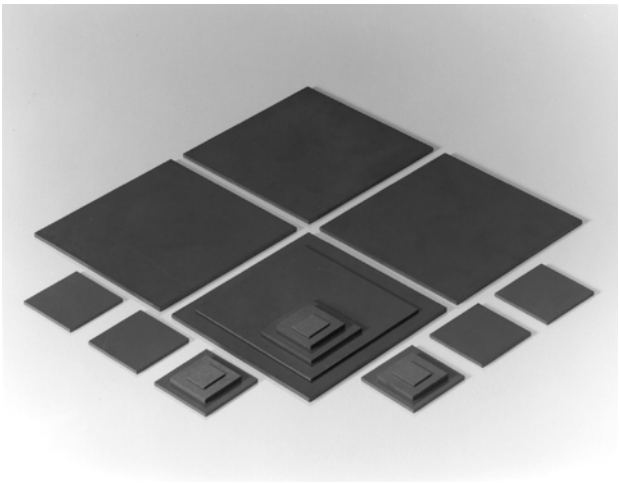
Applications

The Trans-Tech, Inc. (TTI) microwave substrates are designed to meet the demands of devices in the Ultra High Frequency (UHF) to microwave frequency range. TTI's microwave substrates can be metallized for thick film applications, and offer:

- Low loss characteristics
- Temperature stability
- Reduced size and weight that enables circuit miniaturization

Features

- Wide selection of 4πMs
- Small size, weight, and height
- Frequency design
- 200 MHz/100 GHz
- No connectors
- No housing
- Ease of integration with dielectric substrate
- Wide selection of 4πMs values
- Low loss
- Smooth and flat surfaces
- High density



Available Grades

This section describes the three standard surface finish grade selections of magnetic ceramic substrates that are available with custom specifications (provided on request).

Grade 4—Fine Matte 4 µ" to 8 µ"

Grade 4 substrates were designed for thin film Microwave Integrated Circuit (MIC) applications that require superior surface perfection and flatness. Grade 4 substrates are also 100% inspected for all important parameters.

Grade 2—Lapped <16 µ"

Grade 2 substrates were designed for both thick and thin film MIC applications where cost is a consideration, yet controlled electrical and mechanical properties are required.

Grade 1—Surface Ground <32 µ"

Grade 1 substrates were designed for thick film MIC applications where cost is a consideration, and surface perfection is not required.

Note: *Other materials, surface finishes, and thicknesses may be requested, and should be specified on the drawing. Consult TTI's factory for price and availability.*

Trans-Tech™
Ceramics and Advanced Materials

Table 1. Inspection per ASTM-F-109-73

Visual Criteria	Grade 4	Grade 2	Grade 1
Surface Finish (RMS)	4 µ"to 8 µ"	16 µ"	<32µ"
Camber	<0.0005"/inch	<.001"/inch	<0.002"/inch
Chip (W/D)	No single chip to exceed 0.040 inches along the edge, or 0.020" at the deepest point		
Hole, Pit, Pock (Maximum Diameters)	0.010 inches	0.015 inches	0.025 inches
Blemishes	Maximum diameter of 0.030 inches—maximum 6/side or 2/square inches		
Crack Ridges	None	None	None
Inspection Level	100% visual	1% AQL level 2	1% AQL level 2
Length	±0.010 inches	+0.010 inches	+0.010 inches
Width	±0.010 inches	+0.010 inches	+0.010 inches
Thickness Perpendicularity	±0.001" 0.005"/inch	+0.001" 0.005"/inch	+0.001" 0.005"/inch
Parallelism	0.001"/inch	0.001"/inch	0.001"/inch
Radius of Corners (Maximum)	0.010 inches	<0.010 inches	0.010 inches

Thinnest Available by Dimension

Garnet and dielectric materials are available in the following minimum thickness:

- 1 inch x 1 inch = 0.010 minimum
- 1 inch x 2 inches = 0.010 minimum
- 2 inch x 2 inches = 0.020 minimum

Ferrite materials are available in the following minimum thickness:

- 1 inch x 1 inch = 0.015 minimum
- 1 inch x 2 inches = 0.020 minimum
- 2 inches x 2 inches = 0.025 minimum

Visual Criteria

Figure 1 shows a chip, which is an area along an edge or corner where the material has broken off (W = Width, L = Length, and D = Depth).

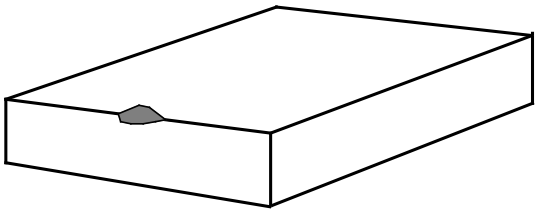


Figure 1. Chipped Substrate

Figure 2 shows a hole, pit, or pock, which is a deep depression or void.

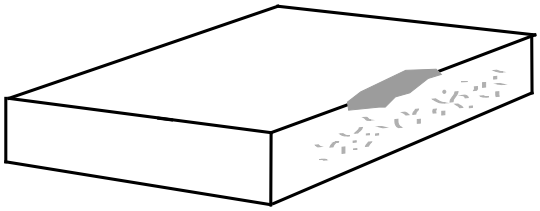


Figure 2. Substrate with a Hole, Pit, or Pock

Figure 3 shows a crack, which is a line of fracture without complete separation.

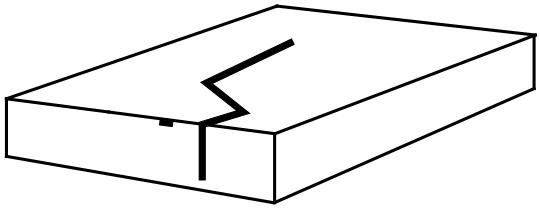


Figure 3. Cracked Substrate

Figure 4 shows a ridge, which is a long narrow protrusion on the surface.

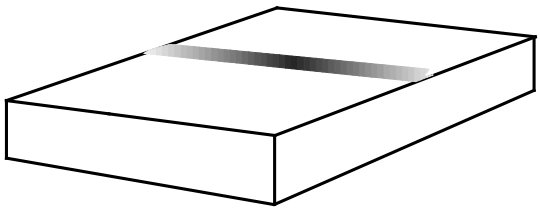


Figure 4. Substrate with a Ridge

Substrate Cleaning Procedure

The cleanliness of the oxide substrate strongly influences the adhesion of thick and thin film metallization. The cleaning procedures that are widely used for alumina (aluminum oxide) are not directly applicable to other ceramic materials such as titanates, ferrites, and garnets.

Many of these procedures incorporate hot, strong acids (e.g., HCl, HF, HNO3, H2SO4, etc.) which are detrimental to these substrates in most cases. Other procedures make use of hot, strong bases (e.g., NaOH, KOH, etc.) as cleansing agents that are also harmful and require extensive rinsing for complete removal. The damage may result in degradation of the surface finish, which causes problems with metallization.

TTI recommends that only mild acidic (pH 2.5-5) and alkaline (pH 9-12) detergents be used to clean substrates. In all cases, TTI recommends cleaning and thoroughly rinsing the substrates with deionized water at about 60°C with ultrasonic agitation.

The cleaning should start with an alkaline cleanser, followed by an acidic cleanser with an intermediate rinse with dionized water. The final rinse is best accomplished with a cascading setup (2–3 baths in series). Substrates should be mounted vertically and separately from each other in a suitable holder, so that the major surfaces are totally exposed to the aqueous cleaner and the ultrasonic agitation.

Substrates should be removed directly from the hot rinse and placed in a clean chamber of hot air dryer (forced draft) set at 70°C to 80°C. For thin film metallization, TTI recommends that the clean substrates be thermally annealed at about 1000°C prior to metal deposition.

Note: *For additional information, contact TTI's factory.*

Ordering Information

Material Type: _____

Grade: _____

Thickness (A): _____

Length (B): _____

Width (C): _____

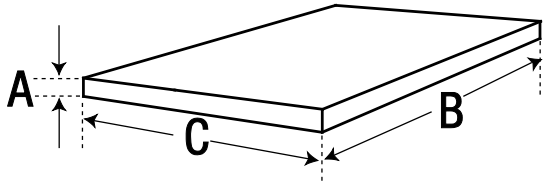


Figure 5. Substrate Dimensions