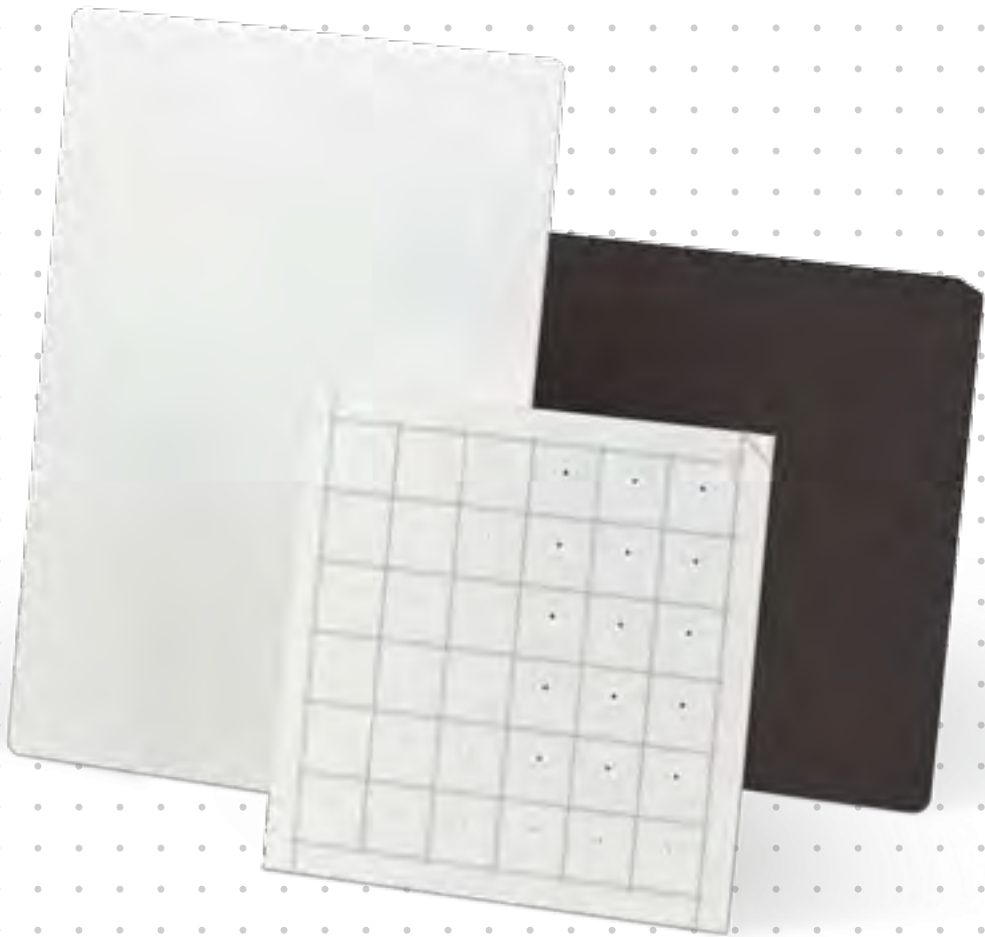




Electronic Substrates Overview

Thin-Film & Thick-Film Ceramic Substrates



CoorsTek is the leader in ceramic substrates for thin-film and thick-film electronics, providing over a dozen substrate types optimized for a variety of processes and applications. Applying our deep expertise in advanced technical ceramics, CoorsTek engineers ceramic materials and substrate processing specifically to the rigorous demands of today's thin-film and thick-film technology.



Thin-Film Ceramic Substrates

CoorsTek thin-film alumina substrates are optimal for most of today's high reliability thin-film electronics applications. By precisely controlling surface finish, grain size, and surface imperfections, CoorsTek substrates enhance fine-line resolution, spacing, and yield in your thin-film process.

SuperStrate® ceramic substrates are the industry standard for high performance, thin-film substrates — providing an exceptionally smooth surface finish for ultra-fine line geometries and outstanding adhesion bond strengths.

MidFilm® Ceramic Substrates

Exclusive CoorsTek MidFilm ceramic substrates provide excellent high-frequency performance using etchable ink and photo-formed electronic processes — delivering strong economic value compared to thin-film deposition processes.

MidFilm substrates work exceptionally well with single and multi-layer circuit designs, filling the gap between thin-film deposition and thick-film processes for applications from high-frequency microwave to photonics and multi-chip modules.



Thick-Film Ceramic Substrates

CoorsTek developed the standards for thick-film alumina substrates, engineered to provide durable and economical performance for hybrid integrated circuits (HIC), sensors, surface mount devices (SMD), and other thick-film electronics. These substrates minimize resistor variation while enhanced aged adhesion.

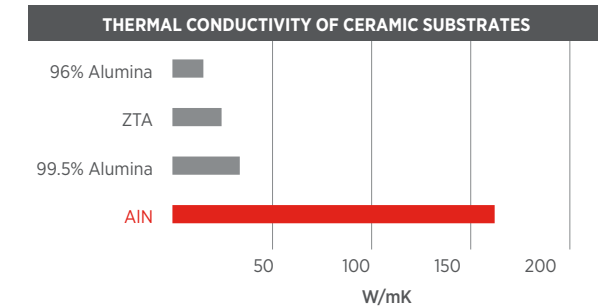
DuraStrate™ ceramic substrates deliver a 20% increase in strength compared to standard thick-film substrates,

particularly useful in applications requiring 0.5 mm (0.020") or thinner form factor.

Aluminum Nitride Substrates

When thermal management is a challenge, CoorsTek aluminum nitride (AlN) substrates help your electronics run cooler — improving performance and extending useful life. Aluminum nitride is an ideal material for LED (light emitting diode) and power electronics applications, uniquely combining:

- excellent thermal conductivity (170 W/m-K)
- high dielectric strength
- thermal expansion coefficient similar to the most common semiconductors like silicon (Si), gallium nitride (GaN), and gallium arsenide (GaAs)



SUBSTRATE PROPERTIES BY FAMILY													
PROPERTY		UNITS	THIN-FILM				MID-FILM	THICK-FILM			SPECIALTY		
			SuperStrate TPS	SuperStrate 996	ADS-996	ADS-995	ADS-995R	DuraStrate ADSR-96R	ADS-96R	ADOS-90R	AlN 170 Aluminum Nitride	AlN 100 Aluminum Nitride	Opaque
Description			Optimal thin-film performance	Industry standard for thin-film technology	Workhorse for most thin-film applications	Economical thin-film alternative	Economical high-frequency performance	20% greater strength for thin substrates	Most popular thick-film substrates	Opaque for light-sensitive devices	Optimal thermal conductivity	High thermal conductivity	Block light transmittance
Applications			Ultra-fine line resolution & spacing				Etchable ink & photo-formed processing				High voltage power electronics and LEDs	Medium voltage power electronics and LEDs	Dark background LED displays
Surface finish	as-fired lapped polished	nm (µ in)	<254 (10) <26 (1)	51 (2) < 254 (10) <26 (1)	77 (3) < 305 (12) < 26 (1)	127 < 762 (30) < 51 (2)	890 (35)	890 (35)	890 (35)	1140 (45)	≤ 600 (25) ≤ 600 (25) ≤ 50 (2)		
Thickness range		mm (in)	0.127 - 1.524 mm (0.005" to 0.060") Standard & custom thicknesses available					0.254 - 3.556 mm (0.010" to 0.140") Custom thicknesses available			0.127 - 1.524 mm (0.005" to 0.060")		
Size range		mm (in)	Standard squares: 25.4, 50.8, 57.1, 63.5, 76.2, 101.6, 114.3, 121.9 mm (1", 2", 2.25", 3", 4", 4.5", 4.8") Standard rounds: 100, 150 mm (3.937", 5.905")					89.9 mm square (3.5") to 139.7 x190.5 mm (5.5" x 7.5") Standard & custom sizes & shapes available			Wafers Ø 50 - 200 mm Up to 200 x 200 mm (8" square)		
Flexural strength		MPa (kpsi)	682 (99)	620 (90)	592 (86)	572 (83)	440 (64)	482 (70)	400 (58)	365 (53)	350 350		
Elastic Modulus		GPa (psi x 10 ⁶)	372 (54)	372 (54)	372 (54)	372 (54)	379 (55)	331 (44)	331 (44)	310 (45)			
Coefficient of linear thermal expansion	25-300 °C 25-1000 °C	1 x 10 ⁻⁶ / °C	6.3 8.2	7.0 8.2	7.0 8.3	7.0 8.3	6.4 8.0	6.4 8.2	6.4 8.2	6.4 8.4	4.4	5.2 5.7	
Thermal conductivity	20 °C	W/m-K	27	26.9	26.6	25.5	31	26	26	13	≥ 170	≥ 100	
Dielectric strength	0.635 mm (0.025") 1.016 mm (0.40")	kV/mm (volts/mil)	640 (25) 500 (20)	600 (23) 450 (17)	22 (575) 450 (17)	22 (575) 450 (17)	23 (595) —	— 470 (18)	600 (25) 490 (19)	21 (540) —	≥ 15 (380) —		
Volume resistivity	25 °C 700 °C	Ω-cm	> 10 ¹⁵ > 10 ¹⁰	> 10 ¹⁴ > 10 ⁹	> 10 ¹⁴ > 10 ⁸	> 10 ¹⁴ > 10 ⁸	> 10 ¹³ > 10 ⁷	4 x 10 ¹⁴ —	> 10 ¹⁴ > 10 ⁸	> 10 ¹⁴ > 7 x 10 ⁵	> 10 ¹⁴ —	> 10 ¹³ —	

Specialty and Custom Substrates

Specialty Ceramic Substrates

Opaque Ceramic Substrates

For light-sensitive semiconductor devices, use CoorsTek opaque ADOS-90R — formulated specifically to block light transmittance and absorb stray light.

Medical Grade Ceramic Substrates

For medical applications, CoorsTek materials are USP Class VI certified.

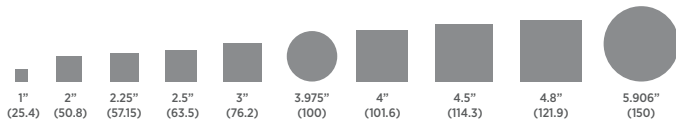
Custom Substrates & Multi-Layer Structures

As a vertically-integrated leader in engineered ceramics and ceramic tape casting, CoorsTek has developed and produced substrates from more than two dozen materials.

CoorsTek also assembles complex multi-layer ceramic substrates that combine precision channels and features in laminated, hermetically sealed structures — providing high-purity, corrosion resistant “circuit” paths for fluids, gases, or air vacuum.

Customize Your Substrates

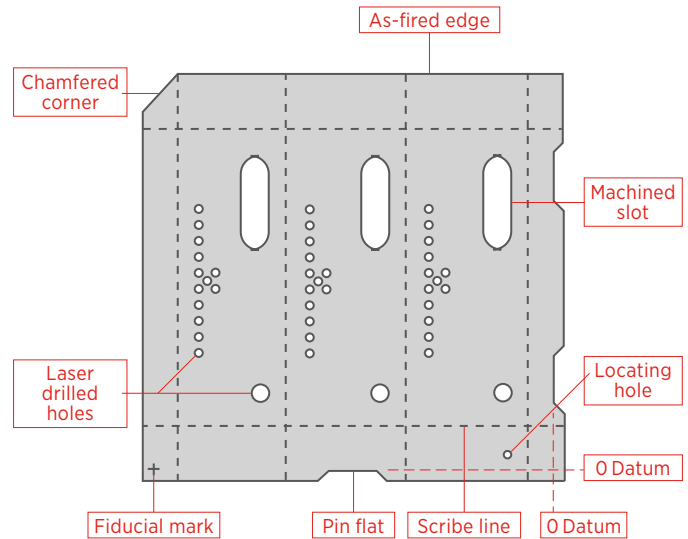
CoorsTek ceramic substrates are available in a wide variety of standard and custom thickness, shape, and size. A host of secondary processing options ensure substrates are configured just the way you need them.



Common substrate shapes & sizes (in inches and (mm))

Beyond providing the best selection of thin-film and thick-film ceramic substrate materials available, CoorsTek partners with you to customize substrates specifically for your application with a range of options:

- Thickness, size & shape
- “As-fired” and finished
- Surface lapping & polishing
- Laser machining & scribing
- Edge finishing
- Annealing
- Metallization & coating
- Precision tolerances
- Cleaning & inspection
- Subassembly & packaging
- Special quality certification (TS-16949, USP Class VI)



Examples of substrate laser machining

Substrate Design Guides

CoorsTek has developed specific, detailed design guidelines for configuring thin-film, thick-film, and aluminum nitride (AlN substrates). Visit coorstek.com for a free download or contact a CoorsTek representative for more information.

About CoorsTek

With over 30 facilities across four continents, CoorsTek is the international partner of choice for companies requiring the unique, high-performance properties of engineered technical ceramics. Learn more at coorstek.com

Consult with CoorsTek Engineers

CoorsTek engineers are available to help you select the optimal material and configure substrate options for your next electronics project. Schedule a consultation now.



Charts intended to illustrate typical properties. Property values vary with method of manufacture, size, and shape of part. Data contained herein is not to be construed as absolute and does not constitute a representation or warranty for which CoorsTek assumes legal responsibility. DuraStrate is a trademark of CoorsTek, Inc. CoorsTek, MidFilm, and SuperStrate are registered trademarks of CoorsTek, Inc.

Americas

+1 303 271 7100 tel
+1 855 929 7100 toll free in USA
www.coorstek.com
info@coorstek.com

Europe

+49 160 530 3768
infoeurope@coorstek.com

Japan

+1 81 3 5437 8411
japaninfo@coorstek.com

China

+86 21 6232 1125
info_shanghai@coorstek.com

Korea

+82 31 613 2946
koreainfo@coorstek.com