AGC
Your Dreams, Our Challenge

AGC Solutions Guide

“Your Dreams, Our Challenge”

Established 100 years ago, AGC has evolved into a world leading supplier of :
architectural / automotive glass, electronic materials such as CMP slurries and silicon carbide, chemicals including fluoro products and refrigerant gases, ceramics such as refractory materials and now multi materials.

AGC’s multi material division is focused on the development of dielectric substrates for high frequency electronics such as high-speed wired and wireless communication, intelligent vehicle, aerospace & defense and next generation satellite communication.

AGC is providing the broadest range of low loss base materials

PTFE Resin System

Thermoset Resin Systems

- PPE
- Hydrocarbon
- Polyimide

www.agc-multimaterial.com

Advanced PCB Materials

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AGC's Multi Material division develops and manufactures a full range of RF and Digital Materials, including thermoset and thermoplastic copper clad laminates and prepreg / bondply substrates, which provide high reliability and superior thermal, mechanical and electrical performance.

Thermoplastic materials are designed for critical RF/Microwave components, antennas, power amplifiers and subassemblies. Superior mechanical and electrical performance make the PTFE resin system the material of choice for your lowest loss, high frequency applications.

Thermoset materials are intended for use in core routers, high speed switches, supercomputers, next-generation radio communication and applications where low signal attenuation, high reliability and high data transfer rates are critical.

PTFE
Resin System

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Part Number	Dielectric Constant (Dk) 10 GHz	Dk Tolerance ±	Dissipation Factor (Df) 10 GHz	Moisture Absorption %	Thermal Conductivity W/M*K	CTE (1) ppm/°C x	y	z	Peel Strength lbs/in Very LowProfile Cu
TLY-5A PTFE-Glass	2.17	0.02	0.0009	0.02	0.22	20	20	280	12
TLY-5 PTFE-Glass	2.20	0.02	0.0009	0.02	0.22	20	20	280	12
TLY-5Z PTFE-Glass	2.20	0.04	0.0015	0.03	0.20	30	40	130	7
TLX-8 PTFE-Glass	2.55	0.04	0.0015	0.02	0.22	21	23	215	12
EZ-IO-F (5 mil thickness) PTFE Ceramic-Glass	2.77	0.05	0.0012	0.08	0.53	19	25	49	5 - 7
TLE-95 PTFE-Glass	2.95	0.05	0.0026	0.02	0.28	9	12	70	12
RF-30A PTFE Ceramic-Glass	2.97(2)	0.05	0.0020	0.05	0.42	8	10	60	12
NF-30 PTFE Ceramic	3.00	0.04	0.0013	0.05	0.50	11	15	30	8
TSM-DS3M PTFE Ceramic-Glass	2.94	0.04	0.0011	0.07	0.65	10	16	23	8
TSM-DS3b PTFE Ceramic-Glass	3.00	0.04	0.0011	0.07	0.65	10	16	23	8
TSM-DS3 PTFE Ceramic-Glass	3.00	0.05	0.0011	0.07	0.65	10	16	23	8
TLC-32 PTFE-Glass	3.20	0.05	0.0030	0.02	0.24	9	12	70	12
RF-35TC-A PTFE Ceramic-Glass	3.50	0.05	0.0017	0.05	0.83	9	13	20	9
RF-35TC PTFE Ceramic-Glass	3.50	0.05	0.0011	0.05	0.92	11	13	34	7
RF-35HTC PTFE Ceramic	3.50	0.05	0.0007	0.07	1.84	11	14	77	6
TLF-35A PTFE Ceramic-Glass	3.50(2)	0.05	0.0022	0.02	0.36	21	23	85	10
RF-60TC PTFE Ceramic-Glass	6.15	0.15	0.0020	0.03	1.05	10	10	40	8
RF-10 PTFE Ceramic-Glass	10.20	0.30	0.0025	0.08	0.85	16	20	25	10

Thermoset Resin Systems

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PPE / Modified Epoxy / Polyimide Laminates

Part Number	Dielectric Constant (Dk)	Dissipation Factor (Df)	Tg °C	CTE(1) ppm/°C			
	10 GHz	10 GHz	DMA	x	y	Z α1	aZ α2
Meteorwave® 1000 Very Low Loss PPE	3.4	0.0047	240	10	14	55	260
Meteorwave® 2000 Very Low Loss PPE	3.2	0.0034	240	10	14	55	260
Meteorwave® 3000 Very Low Loss PPE	3.4	0.0039	200	10	14	55	260
Meteorwave® 3350 High Speed Ultra Low Loss PPE	3.5	0.0038	200	10	14	36	200
Meteorwave® 4000 Ultra Low Loss PPE	3.3	0.0024	200	10	14	55	260
Meteorwave® 4000M Ultra Low Loss PPE	3.3	0.002	200	24	25	55	260
Meteorwave® 5000 HF Halogen Free Ultra Low Loss PPE	3.4	0.0033	185	10	14	46	215
Meteorwave® 6000 HF Halogen Free Ultra Low Loss PPE	3.2	0.0022	185	10	14	46	215
Meteorwave® 8000 Ultra Low Loss PPE	3.28	0.0016	185	14	16	35	185
Meteorwave® 8300 Ultra Low Loss PPE	3.0	0.0025	190	14	16	33	180
Meteorwave® 8350 Ultra Low Loss PPE	3.5	0.0018	185	14	16	35	185
Mercurywave® 9350 Very Low Loss Modified Epoxy	3.5	0.004	200	10	14	48	248
N4000-13 Mid Loss Modified Epoxy	3.6	0.009	240	10	14	70	280
N4000-13 SI® Mid Loss Modified Epoxy	3.2	0.008	240	10	14	70	280
N4000-13 EP Mid Loss Modified Epoxy	3.6	0.009	240	10	14	65	275
N4000-13 EP SI® Mid Loss Modified Epoxy	3.2	0.008	240	9	13	65	275
N4000-29 High Tg Multifunctional Epoxy	4.2	0.017	199	12	15	55	265
N7000-2 HT / -3 Mid Loss Polyimide	3.5	0.009	260 (DSC)	9	12	50	180
N7000-3 Mid Loss Polyimide	3.5	0.009	260 (DSC)	9	12	50	180

Thermoset Resin Systems

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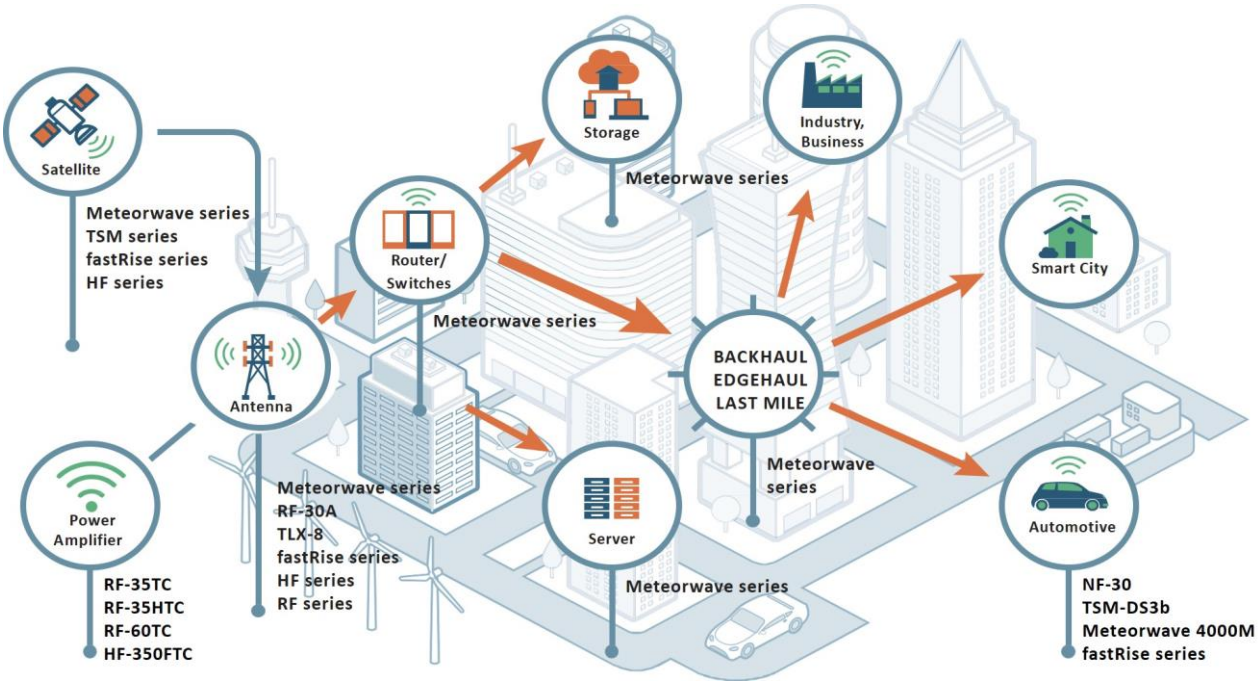
Hydrocarbon Laminates

Part Number	Dielectric Constant (Dk) 10 GHz	Dk Tolerance ±	Dissipation Factor (Df) 10 GHz	Moisture Absorption %	Thermal Conductivity W/M*K	CTE (1) ppm/°C x	y	z	Peel Strength lbs/in Very Low Profile Cu
HF-300F Hydrocarbon	3.00	0.05	0.0029	0.08	0.45	12-18	12-18	65	3
HF-330 Hydrocarbon	3.35	0.08	0.0025	0.04	0.60	12-18	12-18	50	4
HF-340 Hydrocarbon	3.45	0.08	0.0025	0.04	0.60	12-18	12-18	45	4
HF-350F Hydrocarbon	3.50	0.05	0.0029	0.06	0.69	13-17	13-17	63	4
HF-350FTC Hydrocarbon	3.55	0.05	0.0029	0.08	0.8	14-16	14-16	70	7

A Wide Lineup of Products Consisting of PTFE, PPE and Hydrocarbon Products



Prepregs
Bonding Films

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Part Number	Dielectric Constant (Dk)	Dissipation Factor (Df)	Moisture Absorption %	Thermal Conductivity W/M*K	CTE (1) ppm/°C		
	10 GHz	10 GHz			x	y	z
fastRise 25 PTFE/Thermoset	2.43	0.0014	0.08	0.25	59	70	72
fastRise 27 PTFE/Thermoset	2.77	0.0014	0.08	0.25	59	70	72
fastRise 28 PTFE/Thermoset	2.76	0.0014	0.08	0.25	59	70	72
fastRise 7 PTFE/Thermoset	7.45	0.0034	0.10	0.43	10	17	62
fastRiseEZpure Thermoset	2.80	0.0032	0.31	0.33	44	44	44
HB-360 Thermoset	3.65	0.0032	0.08	0.60	15-20	15-20	50

Part Number	Dielectric Constant (Dk)	Dissipation Factor (Df)	Tg °C	CTE(1) ppm/°C			
	10 GHz	10 GHz	DMA	x	y	Z α1	Z α2
M-Ply Ultra Low Loss PPE	3.3	0.0021	200	10	14	55	260

No Flow Prepregs

Part Number	Dielectric Constant (Dk)	Dissipation Factor (Df)	Tg °C	CTE(1) ppm/°C			
	10 GHz	10 GHz	DMA	x	y	Z α1	Z α2
N4000-29NF High Tg Multifunctional Epoxy	4.0	0.0017	199	12	15	55	265
Meteorwave 1000NF Very Low Loss PPE	3.4	0.0047	240	10	14	55	260

Note :
1. All test data provided are typical values and not intended to be specification values.
2. CTE (1) values vary by temperature range of measurement. Please inquire for specific product temperature range.
3. (2) Measured by IPC-TM-650 method 2.5.5.5.1 (modified stripline) at 1.9 GHz.
4. Please refer to the data sheet for each product for detailed values.

Copper Cladding

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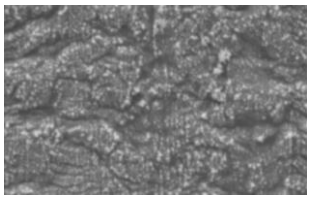
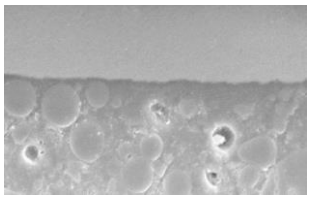
Optical measurements (e.g. Bruker Optical Measurements)

Description	Surface Roughness RMS Treated side		Surface Roughness RMS Untreated side	
	Microinches	Microns	Microinches	Microns
Ultra Low Profile ½ oz	Comparable to rolled copper - see scanning electronmicroscope images below			
Ultra Low Profile 1 oz				
Rolled-Annealed ½ oz	15	0.37	12	0.31
Rolled-Annealed 1 oz	11	0.28	9	0.24
Reverse Treated Electrodeposited ½ oz	46	1.16	44	1.12
Reverse Treated Electrodeposited 1 oz	39	1.00	52	1.31
High Ductility Very Low Profile Electrodeposited ½ oz	66	1.68	18	0.46
High Ductility Very Low Profile Electrodeposited 1 oz	60	1.54	19	0.49

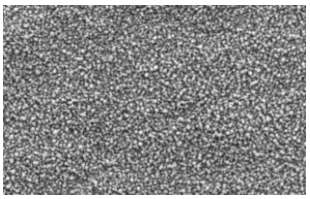
* Above copper foil types may not be available for all AGC products, please contact your technical service representative with questions.



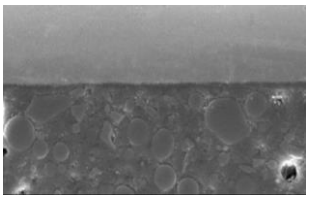
Rolled-Annealed Copper
(Treated surface)
x 3,000



Rolled-Annealed Copper
(Cross section)
x 1,000



Ultra Low Profile Copper
(Treated surface)
x 3,000



Ultra Low Profile Copper
(Cross section)
x 1,000

OhmegaPly®, Ticer® and other resistive foils available upon request.
OhmegaPly® is a registered trademark of Ohmega Technologies, Inc. Ticer® is a registered trademark of Ticer Technologies.

- ½ oz. copper = 0.7 mils or 17.5 microns
- 1 oz. copper = 1.4 mils or 35.0 microns
- 2 oz. and other coppers available upon request

Optical measurements are not accurate to characterize the differences between ultra low profile and rolled-annealed copper. Scanning electron microscope analysis shows a very comparable surface roughness. Insertion loss comparisons are available by request.