
RF and Microwave Substrates Directory

Please note that the comments included are extracted from suppliers' brochures and other publicity material and are NOT those of Trackwise.

Arlon

www.arlonmed.com

FoamClad 100 (Now discontinued)

'Low permittivity microporous polymeric core bonded to an impermeable copper-clad polymeric film coverlay that provides a low composite dielectric constant'.

DiClad series

'Offer a choice from the lowest dielectric constant and dissipation factor to a more highly reinforced laminate with better dimensional stability'.

See also below for -PIM laminates.

CuClad series

'Offer a choice from the lowest dielectric constant and loss tangent to a more highly reinforced laminate with better dimensional stability' laminates are cross-plyed, providing true electrical and mechanical isotropy in the XY plane, a feature unique to CuClad'.

IsoClad series

- 'The non-woven reinforcement allows these laminates to be used more easily in applications where the final circuit will be bent to shape'.
- 'Use long random fibres and a proprietary process to provide greater dimensional stability and better dielectric constant uniformity'.

25N

'Designed for performance in high frequency applications where conventional material dielectric constant and losses are inadequate for the circuitry and the high cost of PTFE substrates is prohibitive'.

25FR

Flame resistant (UL94 V-0) equivalent to 25N.

AD Series

- 'Combine the excellent low loss electrical properties of PTFE with the enhanced value of woven fibreglass to provide low cost laminate materials'.
- 'AD350A – higher thermal conductivity and low CTE promote its use in high power designs'.

See also below for -PIM laminates.

AR Series

- 'AR320: the higher weight ratio of fibreglass to PTFE yields a laminate with greater dimensional stability'.
- 'AR350/450: designed to offer dielectric constants similar to thermo set laminates with much better dielectric constant uniformity, both within a sheet and between sheets'.
- 'AR600/1000: higher dielectric constant'.
- 'Soft substrates not sensitive to vibrational stress. This permits circuit miniaturization without requiring complicated processing or fragile handling associated with pure ceramic material'.

Our Suppliers

Arlon
CLP Industries Ltd
GE
Hitachi
Gore
Krempel
Isola
Neltec (Was Metclad)
Polyflon
Rogers
Sheldahl
Taconic

CLTE and CLTE-LC

- ‘A reduced Z-direction thermal expansion, improving plated through hole reliability. It is also stable during subsequent thermal cycling’.
- ‘Temperature stability simplifies circuit design and optimizes circuit performance in many microwave applications’.
- ‘Thermally stable dielectric constant’.
- ‘CLTE-LC is designed to offer all of the same properties and functionality as CLTE, but, in most cases, at a reduced cost’.

CLTE-XT

- ‘Excellent Dimensional stability with high degree of phase stability vs. temperature’.
- ‘Excellent Thermal Stability of Dk and Df’.
- ‘Phase Stability across temperature’.
- ‘High Degree of Dimensional Stability required for complex, multi-layer boards’.
- ‘Excellent CTE in X, Y and Z Directions’.

PIM Laminates

- ‘DiClad 880-PIM, AD250-PIM, AD300-PIM, AD320-PIM’.
- ‘Reduced passive intermodulation (PIM) laminates’.
- ‘Engineered to reduce the contribution made by the base laminate to PIM loss and distortion figures’.
- ‘The result of optimising the interface between the copper and laminate...is a series of materials that demonstrate reductions in PIM of up to 20dB compared with standard laminates’.

MultiClad HF Series

‘Arlons new halogen-free low-loss system represents the next generation low-loss thermoset system for high speed and high frequency printed circuit boards. This new technology combines a low-loss, high reliability thermoset resin system with non-brominated flame retardant system to create a material that is unmatched in terms of electrical performance, durability and cost’.

CLP Industries Ltd

www.clp.co.il

CLP industries Ltd has accumulated 30 years of experience in lamination of various polymer films and metals foils for packaging and various industrial and engineering applications.

CLP developed new MW laminates, which offer high dielectric performance and low pricing comparing to existing Teflon (PTFE) based laminates, without compromising the loss angle tangent (Df is 0.0004 @ 10 Ghz).

GE

www.geplastics.com

GETEK

‘Improved thermal and electrical properties needed for sophisticated circuitry – along with significant cost savings’.

GETEK II

- ‘Laminates and prepregs offer the ideal solution for high end PCB component design’.
- ‘Lowest loss on e-glass reinforced material’.
- ‘Low z-axis expansion’.
- ‘Low moisture absorption for stable electrical and thermal properties’.

GIL

GIL Technologies closed permanently on 31st January 2003.

Please contact us for alternatives.

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Hitachi

www.hitachi-chem.co.jp

MCL-LX-67F

'Transmission loss is about 30% of FR-4 and equal PTFE'.

Gore

www.goreelectronics.com

Krempel

www.krempel.com

Akaflex

- 'A family of products comprising flexible and semi-flexible laminates'.
- 'Can be processed from roll to roll'.

PCL

'Low shrinkage polyester film'.

KCL

- 'Polyimide film'.
- 'Excellent temperature and solder resistance and good dimensional stability'.

GHE

- 'Semi-flexible base laminate'.
 - 'Glass fabric impregnated with modified epoxy resin'.
 - 'Improved rigidity and increased dimensional stability'.
-

Isola

www.isola-usa.com

Astra™

- 'Astra™ laminates are a breakthrough, very low-loss dielectric constant (Dk) product for millimeter wave frequencies and beyond.'
- 'Astra laminate materials exhibit exceptional electrical properties which are very stable over a broad frequency and temperature range. Astra is suitable for many of today's commercial RF/microwave printed circuit designs'.
- 'It features a dielectric constant (Dk) that is stable between -55°C and +125°C at up to 20 GHz'.
- 'In addition, Astra offers a lower dissipation factor (Df) of 0.0017 making it a cost-effective alternative to PTFE and other commercial microwave laminate materials'.

IS680

- 'IS680 laminate materials exhibit exceptional electrical properties which are very stable over a broad frequency and temperature range'.
- 'It's suitable for many of today's commercial RF/Microwave printed circuit designs'.
- 'It offers a low dissipation factor (Df) of 0.0030 making it a cost effective alternative to PTFE and other commercial microwave laminate materials'.

Gigaver 210/410

Now discontinued. Please contact us for alternatives.

- ISO620 (Low Loss with Flat Response Over Frequency).
- IS620 is the first material in the digital-products class built upon existing technologies, yet offering significant advantages for today's digital world. The resin matrix of IS620 is uniquely formulated for high-speed applications ranging from 2 to 10 GHz, providing a low, flat loss response over the entire range.
- It is optimal for digital designs and is available in both laminate and prepreg in all typical thickness and standard panel sizes. IS620 offers the designer and fabricators the flexibility of digital design, the assurance of supply, and the ease of conventional FR-4 processing.

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Sheldahl

Taconic

- IS620 is the first material in its class to offer the complete package of each of the critical items: low loss with a flat response over frequency, availability in both laminate and prepreg form in typical thickness and sizes, and the ability to use conventional fabrication techniques.

Neltec (was Metclad)

www.parknelco.com

NL9000

- 'The NL9000 PTFE laminate system is designed for critical RF/microwave components, antennas, power amplifiers and subassemblies'.
- 'Superior mechanical and electrical performance make the NL9000 PTFE laminate system the material of choice for your lowest loss, high frequency applications'.

N9000 Laminate system

- 'Passive intermodulation performance up to 25% better than other non-woven or woven PTFE laminates'.
- 'Foil adhesion is 50-100% better than competitive glass reinforced PTFE laminates and 200-300% greater than ceramic loaded PTFE laminates on the market'.

NY

'Low glass: PTFE ratio for lowest loss applications'.

NX Series

'Medium glass: PTFE ratio for increased mechanical strength'.

NH Series

'Medium glass: PTFE ratio with ceramic added for thermal stability and Dk uniformity'.

N4000-13 Series

- 'Superior choice for high speed and low loss designs when compared to conventional epoxies, BT epoxies or thermoplastic modified epoxies'.
- 'High Tg, together with inherent toughness, makes N4000-13 ideal for withstanding multiple thermal excursions while maintaining electrical performance'.

N9000-13 RF

- 'Combines the RF electrical performance of PTFE with the competitive performance features of epoxy'.
- 'Excellent solution for cost-sensitive applications'.

NH9450

- 'Nelco® product line type NH9450 material is a high performance PTFE copper clad laminate, with a nominal dielectric constant of 4.50'.
- 'It is re-enforced with special woven glass developed for PTFE coating, and ceramic filled'.
- 'The ratio of PTFE/Glass/Ceramic is very tightly controlled to accurately maintain the specified electrical values of the laminate and a precise thickness tolerance'.

N9350 (Mercurywave) Series

Mercurywave™ 9350 is lead-free assembly compatible and RoHS compliant. Mercurywave™ 9350 is well suited to RF and Microwave applications such as Broadband Communications, WiFi/WiMax and RFID, as well as Power Amplifier, Filter, Combiner, Radar and Guidance devices.

Polyflon

www.polyflon.com

Norclad

- 'Made from thermoplastic material PPO (polyphenylene Oxide)'.
- 'Very uniform and reproducible electrical properties, and stable over temperature'.

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Polyguide

- ‘Precision fabricated from highest quality, high density polyolefin’.
- ‘Irradiation permanently imparts improved electrical homogeneity and mechanical toughness while significantly enhancing the temperature and chemical resistance of the material’.
- ‘Electrical properties remain constant up to and beyond 18GHz’.

CuFlon

- ‘Dielectric is pure PTFE’.
- Copper-Clad ULTEM.
- ‘Made from amorphous thermoplastic material PEI (polyetherimide)’.
- ‘Isotropic electrical and mechanical properties with an exceptional thermal conductivity’.

Rogers

www.rogerscorporation.com/acm

All laminates have V-0 flammability rating (UL-94) with the exception of RO4003.

RO3000 series

- ‘A line of PTFE materials with mechanical properties which are the same regardless of dielectric constant’.
- ‘XY expansion coefficient matches that of Copper which allows the material to exhibit excellent dimensional stability’.

RO3200 series

- ‘Laminates combine the surface smoothness of a non-woven PTFE laminate, for finer line etching tolerances, with the rigidity of a woven-glass PTFE laminate’
- ‘The RO3200 series were designed as an extension of the RO3000 series, with one distinguishing characteristic, improved mechanical stability’.

RO4000 series

- ‘Non PTFE laminates, designed for performance sensitive, high volume commercial applications’.
- RO4730 LoPro laminate materials combine low-loss dielectric with low-profile copper foil for reduced passive intermodulation (PIM) and low insertion loss.

RO4500 series

- ‘Extends the capabilities of the successful RO4000 products series into antenna applications’.
- ‘This ceramic-filled, glass-reinforced hydrocarbon based material set provides the controlled dk, low loss performance and excellent passive intermodulation response required for mobile infrastructure microstrip antenna applications’.

RO4500™ and RO4730™ LoPro™ antenna grade laminates

‘These extend the RO4000 product series into large volume antenna applications. The ceramic filled, glass reinforced, hydrocarbon based material provides the controlled dielectric constant, low loss performance and excellent passive intermodulation response required for mobile infrastructure microstrip antenna applications’.

Ultralam 2000 series

‘Maximises dimensional stability and minimises etch shrinkage where circuit feature registration is critical’.

RT/duroid 5000 series

- ‘Microfibres randomly oriented to maximise benefits of fibre reinforcement’.
- ‘Dissipation factor extends usefulness to Ku-Band and above’.

RT/duroid 5880LZ

‘PTFE composites are designed for exacting stripline and microstrip circuit applications. The unique filler results in a low density, lightweight material for high performance weight sensitive applications. The very low dielectric constant of RT/duroid 5880LZ laminates is uniform from panel to panel and is constant over a wide frequency range. Its low dissipation factor extends the usefulness of RT/duroid 5880LZ to Ku-band and above’.

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RT/duroid 6000 series

- ‘First low loss and low dielectric constant laminate to offer superior electrical and mechanical properties’.
- ‘Extremely low coefficient of dielectric constant from -55C to +150C’.
- ‘Exceptional dimensional stability is achieved by matching XY coefficient of thermal expansion to that of Copper’.

RT/duroid 6006/6010

‘Close dielectric control, nearly isotropic electrical properties and low moisture absorption’.

TMM series

- ‘Electrical and mechanical properties of TMM laminates combine many of the benefits of both ceramic and traditional PTFE microwave circuit laminates, without requiring the specialised production techniques’.
- ‘Exceptionally low thermal coefficient of dielectric constant’.

RO3730 Series

Introducing RO3730™ antenna grade laminates – our newest antenna material offering low PIM and lower cost for high volume applications.

RO4360™ High Frequency Laminates

‘RO4360™ laminates are 6.15 DK, low loss, glass-reinforced, ceramic-filled thermoset materials that provide the ideal balance of performance and processing ease. RO4360 laminate extends Rogers’ portfolio of high performance materials by providing customers with a product that is lead-free process capable and offers better rigidity for improved processability, while reducing material and fabrication costs.

RO4360 laminates, with a DK of 6.15, allow designers to reduce circuit dimensions in applications where size and cost are critical. They are the best value choice for engineers working on designs including power amplifiers, patch antennas, ground-based radar, and other general RF applications’.

SYRON 7100

SYRON 7100 are thermally stable, with a melt temperature higher than PTFE materials and an estimated relative thermal index (RTI) greater than 210°C (410°F). The SYRON products possess impressive chemical and radiation resistance. These lead-free solder capable laminates are green materials which are naturally flame retardant and halogen free.

Sheldahl

www.sheldahl.com

ComClad HF

- ‘Excellent electrical properties’.
- ‘Especially attractive because of the combination of a dielectric constant of 2.6, a dissipation factor of 0.0025 and very low prices’.
- ‘Uses a common plastic as the base dielectric so designers can form, mould, bend and even insert-mould it in a plastic injection process’.

Taconic

www.taconic-add.com

- ‘Our precise manufacturing process results in a laminate with a uniform thickness profile, a precise dielectric constant and a consistently low dissipation factor through the entire sheet’.
- ‘Maintaining precise control provides exceptional lot-to-lot consistency’.
- ‘Unique capability to manufacture base materials in sheet sizes up to 36”x116”.
- All laminates have V-0 flammability rating (UL-94).
- Copper : R – rolled annealed C/CV/CL – electrodeposited (CL is very low profile).

TLX series

- ‘Exceptionally well controlled electrical and mechanical properties’.
- ‘Dimensionally stable and exhibit virtually no moisture absorption during fabrication processes’.

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TLC series

- ‘Engineered to provide a cost effective substrate’.
- ‘Offer far superior electrical performance compared to thermoset laminates’.
- ‘The construction of the laminate provides exceptional mechanical stability’.
- ‘Other dielectric constants are available upon request’.

TSM-30

- ‘Thermally stable material.’
- ‘Consistent performance over broad temperature and frequency ranges’.

TLY series (also TLP series)

- ‘The exceptionally low dissipation factor extends the usefulness of this product to 35GHz and above’.

TLE series

- ‘Engineered to provide electrical and mechanical properties to meet the requirements of complex microwave and high speed digital applications’.
- ‘The low Z-axis CTE provides excellent plated through hole reliability’.
- ‘The low thermal expansion properties in the X and Y plane ensure reliability in surface mount applications’.
- ‘Dk exhibits minimal change over temperature’.

TacLam series

- ‘Combination of fluoropolymer resin, woven fibreglass, BT epoxy and ceramic’.
- ‘Enhanced stiffness over PTFE-based laminates’.

RF-30

- ‘Combines the benefits of woven glass reinforced fluoropolymer chemistry with the thermal, mechanical and electrical enhancements of ceramic elements’.
- ‘Similarly priced as TLC-30 grade however the loss-tangent is significantly lower’.

RF-34

- ‘RF-34 is an organic-ceramic laminate in the ORCER family of Taconic products’.
- ‘Best choice for low cost, high volume & high frequency applications’.
- ‘Ultra low moisture absorption rate and low dissipation factor minimize phase shift with frequency’.

RF-35

- ‘Ultra low moisture absorption rate and low dissipation factor minimise phase shift with frequency’.
- ‘Excellent copper peel strength, a critical aspect whenever rework is required’.
- RF-35A2 has all of the benefits that you have come to expect from the RF-35 product line, including excellent copper peel strength for rework and reliability and low moisture absorption for fewer bakes and lower cost during processing.

TLF-35 & TLF-34

TLF-34 and TLF-35 are the best choice for low cost, high volume commercial microwave and radio frequency applications. RF-35 has excellent peel strength for 1/2 ounce and 1 ounce copper (even in comparison to standard epoxy materials), a critical aspect whenever rework is required. The ultra low moisture absorption rate and low dissipation factor of the TLF range of substrates minimize phase shift with frequency.

TRF-41 & TRF-43 & TRF-45 series

These Laminates are suitable as a low loss alternative to FR-4 materials.

If you have any comments, suggestions, or new materials that you would like added, please email us: enquiries@trackwise.co.uk