

Genestar™

PA9T for blister-resistant reflow connectors

About GENESTAR™ PA9T

GENESTAR™ is a brand name of heat resistant polyamides developed by Kuraray. GENESTAR™ PA9T in that brand is a well-balanced long-chain polyphthalamide (PPA) that combines a low water absorption and high mechanical properties over a broad temperature range.

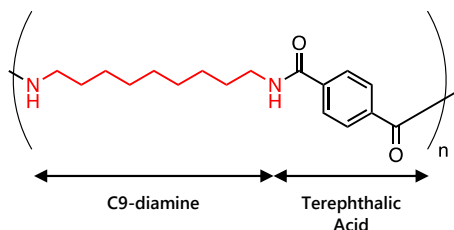


Figure 1: PA9T structure

GENESTAR™ PA9T properties come from its C9-diamine monomer tailored for reflow applications. The main advantages of GENESTAR™ PA9T are:

- A low water absorption
- Superior dimensional stability
- JEDEC MSL1 blister resistance
- CTI > 600 V (PLC class 0)
- Good processability
- High weld-line strength and colorability

These properties make GENESTAR™ PA9T extremely suitable for reflow applications as evidenced by its proven track record for 20 years in numerous soldered parts at leading connector companies. Portfolio of GENESTAR™ comprises solutions for very thin components used in surface mount technology (SMT) as well as for more robust through hole reflow (THR) connectors.

Automotive Connectors

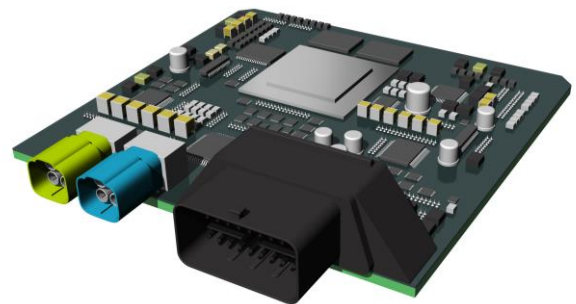
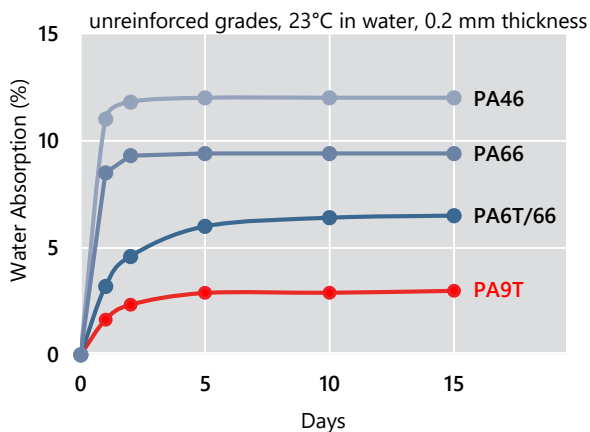


Figure 2: Automotive connectors

For the design of automotive connectors, a multitude of requirements should be taken into account such as the influence of a varying temperature and humidity, exposure to severe vibrations, flammability, ease of processing, isolation properties and storage time or overseas shipping before production of the PCB.

In contrast to many resins that are optimized in one dimension and offer the best-in-class performance for a specific property, GENESTAR™ PA9T resins differentiate themselves with its well equilibrated performance profile. Due to its high and even performance in multiple properties, GENESTAR™ PA9T has a strong reputation as problem-solver for demanding reflow connectors and can facilitate the challenges design engineers has to conquer.

Low Water Absorption



Graph 1: Water absorption of various polyamides

Polyamides are the best choice in terms of mechanical properties and electrical properties. However, a common drawback these materials experience is the negative effect of water absorption during their lifetime. Particularly the deterioration of mechanical properties, dimensional changes and occurrence of blisters during the reflow process are consequences of water absorption.

Thanks to PA9T's characteristic long hydrophobic carbon chain, PA9T shows a low water absorption yielding specific advantages compared to competing high temperature nylons as can be observed in next paragraphs.

Reflow Blister Resistance

	Peak temperature (°C)				
	230	240	250	260	265
PA9T	✓	✓	✓	✓	✓
PA10T	✓	✓	✓	✗	✗
PA4T	✓	✓	✗	✗	✗
PA6T/66	✓	✗	✗	✗	✗
PA46	✗	✗	✗	✗	✗



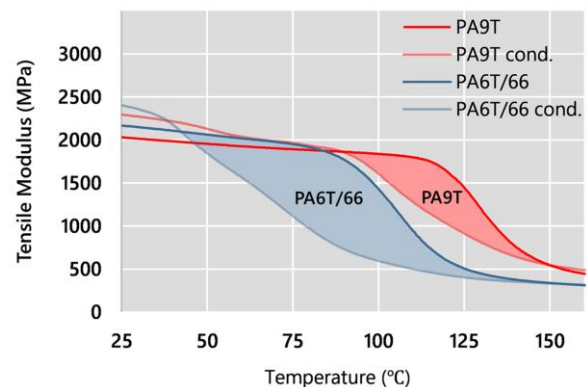
Figure 3: Blister resistance of various polyamides-based compound

An essential property for reflow connectors is the blister-resistance since blisters are one of the main reasons for part disqualification. For polyamides, these blisters are the result of water turning into steam that is not capable

to escape during the fast temperature ramp-up. For connectors with a higher wall-thickness found back in automotive parts, this issue becomes even more severe.

The lower the water absorption, the better the blister resistance, which makes GENESTAR™ PA9T one of the top performers in the industry. This premium blister-resistance is also evidenced with its JEDEC MSL 1 rating, the highest possible moisture sensitivity level.

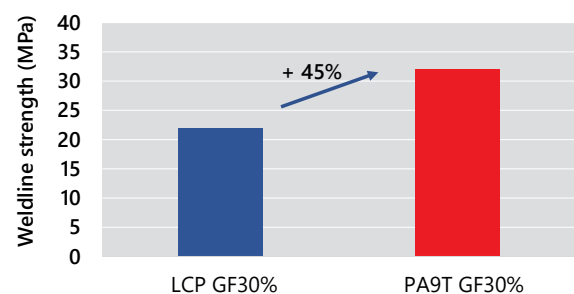
Consistently High Mechanical Strength over a Wide Range of Temperatures and Moisture



Graph 2: Comparison of tensile modulus for dry and saturated condition of PA6T/66 and PA9T-based compound (unreinforced)

GENESTAR™ PA9T combines a high glass transition temperature (T_g) of 125°C with a high degree of crystallinity. With the chemical structure of PA9T, it maintains superior stiffness in a wide range of temperature settings and moisture level. This combination of properties, which is difficult to find in other polyamides, makes GENESTAR™ PA9T an excellent choice for applications that require good mechanical properties at elevated temperatures near engine compartments at different relative humidity.

Weld-line Strength



Graph 3: Weld-line strength of LCP and PA9T-based compound

A part is only as strong as its weakest point, which is situated at the weldline for injection molded plastic parts. Although LCP is from a pure flow perspective and blister-resistance an interesting material, it compromises strongly on weldline strength.

When parts are subjected to severe vibrations and subjected to stresses, the higher toughness found back in GENESTAR™ PA9T can offer a significant advantage. This improved weldline strength offers design engineers a wider degree of freedom and a valuable alternative including the possibility for snap-fits.

Comparative Tracking Index

Voltage	CTI class	PA9T	PBT	PPS	LCP
600 >	0	✓			
400 – 599	1	✓			
250 – 399	2		✓		
175 – 249	3		✓	✓	✓
100 – 174	4			✓	✓
< 100	5				

Graph 4: CTI level of various polymer-based compound

PA9T shows good electrical tracking resistance. Electrical powertrain in EV, HEV, FCV and its control unit requires high voltage management. There is a technical trend that automotive high voltage connector change from DIP to SMT type. PA9T allows engineers of automotive connector to design high-voltage SMT connectors.

With a CTI's performance level category (PLC) of 0 for the majority of GENESTAR™ PA9T grades, there is less susceptibility of the material to surface tracking of solid electrical insulating materials even under electrical stress, water and other contaminants.

Coloring with GENESTAR™ PA9T



Figure 4: Colorability of GENESTAR™ PA9T

Automotive connectors come in many colors to provide easy identification of connection between the many connectors. LCP showed weakness in vibrant colors. Other polyamides showed wide color change before and after reflow soldering. GENESTAR™ PA9T provides the vibrant colors with smaller color change before and after reflow soldering.

Technical Support

An engineer has often limited resources to consider new materials. However we strongly believe that GENESTAR™ PA9T has the power of innovation. Therefore we like to partner up with our customers and support them as much as possible during development stage.

We have many years of experience in the E&E and automotive field. We can support customers in CAE analysis, technical support during molding trials and trouble shooting.

Contact Information

For further information or inquiries about GENESTAR™, feel free to contact us directly (see next page) or visit our website.

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About KURARAY

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