

# Makrolon® mono clear 099. Polycarbonate sheet.

## Impact strength

The toughest glazing material known today, polycarbonate has 250 times the impact strength of glass of the same thickness. The notched IZOD impact strength at 23°C is 30-40 times higher than that of regular PMMA sheet and even at -55°C it is still 3-4 times higher than that of regular PMMA sheet at room temperature. This virtually indestructible material gives the maximum possible protection against vandalism, robbery, etc. Makrolon® mono clear 099 sheet meets the DIN 52 290 Class A3 (highest class) requirements for attack blocking glazing. This means that it withstands a steel ball of 4.11 kg falling 3 times on the same sheet from a height of 9.5 m.

## Heat resistance

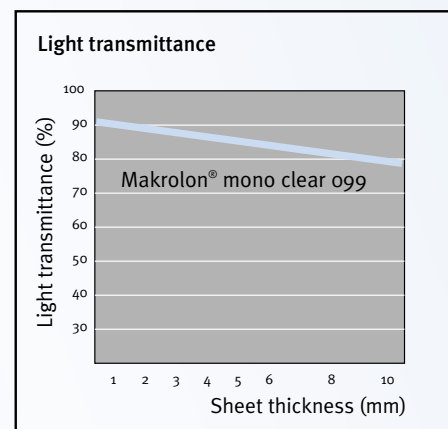
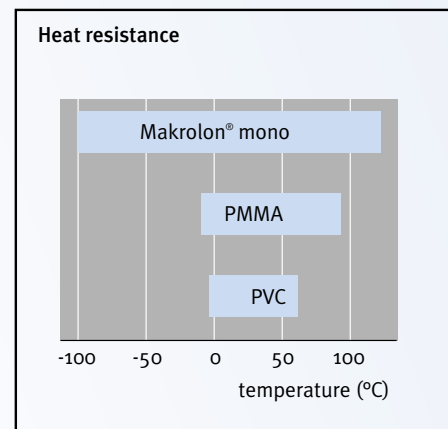
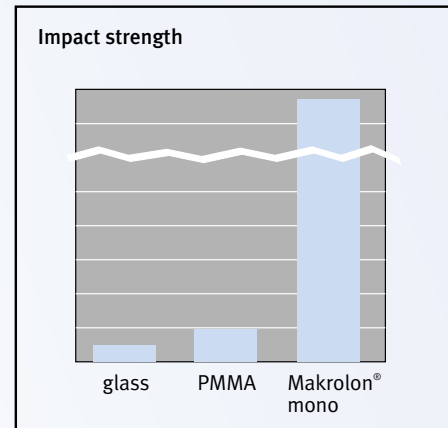
Makrolon® mono clear 099 sheet can be used in a broad temperature range. It can withstand a continuous temperature in air of 120°C, but it can also be used at extreme cold temperatures down to -100°C. This makes it stand way out in its class, compared with other transparent sheet products such as PMMA, PET or PVC.

## Light transmittance

Makrolon® mono clear 099 sheet offers extreme optical clarity and high gloss. While UV-radiation is almost completely absorbed, the light transmittance of clear transparent Makrolon® mono clear 099 sheet over the visible range rises to about 90% (1 mm thick sheet), decreasing with increasing thickness.

## Technical information

Detailed technical information on Makrolon® mono clear 099 sheet can be found on our website at [www.makroform.com](http://www.makroform.com).



Makroform GmbH D-64293 Darmstadt  
Tel. +49 (0) 6151/183 90 00  
Fax +49 (0) 6151/183 90 07

Makroform N.V. B-8700 Tielt  
Tel. +32 (0) 51/42 62 00  
Fax +32 (0) 51/42 62 02

Makroform S.p.A. I-20156 Milano  
Tel. +39 02/39 23 15 1  
Fax +39 02/39 23 15 643

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between Bayer AG and Röhm  
GmbH & Co. KG.

Makroform on the Internet:  
[www.makroform.com](http://www.makroform.com)

E-Mail: [sales@makroform.com](mailto:sales@makroform.com)

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**THE LONG-TERM-PARTNER**

# Makrolon® mono clear 099. Polycarbonate sheet.

	Typical values	Unit	Test method
<b>PHYSICAL</b>			
Density	1.20	g/cm <sup>3</sup>	ISO 1183
Moisture absorption:			
- saturated at 23°C/50% RF	0.15	%	ISO 62, method 4
- saturated in water of 23°C	0.35	%	ISO 62, method 1
Index of refraction 20°C	1.586		ISO 489
Lighttransmission (3 mm sheet)	88	%	DIN 5036
<b>MECHANICAL</b>			
Tensile stress at yield	60	MPa	ISO 527-2/1B/50
Elongation at yield	7	%	ISO 527-2/1B/50
Tensile strength	50-80	MPa	ISO 527-2/1B/50
Elongation at break	> 60	%	ISO 527-2/1B/50
Tensile modulus of elasticity	2400	MPa	ISO 527-2/1B/1
Limiting flexural stress	90	MPa	ISO 178
Impact strength:			
- Charpy unnotched	no break	kJ/m <sup>2</sup>	ISO 179/1 fu
- Charpy notched	~ 10	kJ/m <sup>2</sup>	ISO 179/1 eA, thickness ≥ 4 mm
- tensile impact strength	≥ 150	kJ/m <sup>2</sup>	ISO 8256, method A, <4 mm
- Izod notched	10	kJ/m <sup>2</sup>	ISO 180 1A
Ball indentation hardness H 358/30	130	N/mm <sup>2</sup>	ISO 2039-1
<b>THERMAL</b>			
Vicat softening temperature	145	°C	ISO 306, method B50
Thermal conductivity	0.20	W/mK	DIN 52612
Coeff. of linear thermal expansion	0.065	mm/m°C	DIN 53752-A
Heat deflection temperature under load acc. to ISO/R75			ISO 75
- method A: 1,81 MPa	135-140	°C	
Max. service temperature in air:			
- continuously <sup>(1)</sup>	120	°C	
Min. service temperature	-100	°C	
<b>ELEKTRICAL</b>			
Dielectric strength <sup>(2)</sup>	35	kV/mm	IEC 243-1
Volume resistivity	> 10 <sup>16</sup>	Ohm · cm	DIN VDE 0303; part 3
Surface resistivity	> 10 <sup>15</sup>	Ohm	DIN VDE 0303; part 3
Dielectric constant at 50 Hz	3.0		DIN VDE 0303; part 4
Dielectric factor at 50 Hz	0.0007		DIN VDE 0303; part 4
Tracking resistance	250-300	rating	DIN VDE 0303; part 1
<b>FIRE BEHAVIOUR <sup>(3)</sup></b>			
Oxygen index (LOI) UK:	25-27	%	ISO 4589
- 4 mm sheet	class 1	rating	BS 476/part 7
	≤ 12 (I), ≤ 6 (ii)	rating	BS 476/part 6
	150	°C	BS 2782-102A
Germany:			
- 1 to 4 mm sheet	B1	rating	DIN 4102/part 1
- 5 mm sheet	B2	rating	DIN 4102/part 1
France:			
- 3, 10 to 12 mm sheet	M2	rating	NFP 92-501&5
- 0,75 mm sheet	M1	rating	NFP 92-501&5

- extreme impact strength
- broad temperature resistance
- good fire behaviour
- high transparency

## Description

Makrolon® mono clear 099 sheet is a clear, polished surface, UV-stabilized polycarbonate sheet for use in glazing and industrial applications. Makrolon® mono clear 099 sheet offers extreme impact strength, exceeding the physical properties of any product in its class. It combines temperature resistance in a wide range (-100 up to +120 °C) with high optical clarity and good fire behaviour. Makrolon® mono clear 099 can be thermoformed and offers ease of machining.

## Applications

Makrolon® mono clear 099 sheet is used extensively in school and factory glazing for protection against both accidental breakage and deliberate vandalism. In manufacturing environments, this high impact material excels in applications like machine guards, noise reflecting shields, clear work station partitions, freight doors and other inplant glazing.

## Availability

Makrolon® mono clear 099 sheet is available in clear transparent in the thickness range of 0.75 up to 12 mm.

Standard size : 1250 x 2050 mm  
2050 x 3050 mm

Other sizes and thicknesses on request.

*The above-mentioned values are typical values at 23°C, unless otherwise stated. They are intended as a guideline for material determination. They cannot be used for drawing up material specifications.*

- (1) Temperature resistance over a period of several months to several years. The given temperature limits are determined by the thermal-oxidative degradation which takes place and causes a fall-off in properties (embrittlement). Besides, as for all thermoplastics, the maximum service temperature depends essentially on the duration and the magnitude of the mechanical stress to which the material is subjected.
- (2) Measured on a 1 mm thick test specimen. As with other materials, the dielectric strength diminishes with increasing sheet thickness, e.g. for 3 mm sheet the dielectric strength is 14 kV/mm, for 6 mm sheet 9 kV/mm.
- (3) These ratings are not intended to reflect hazards presented by the material under actual fire.

**Product liability clause:** This information and our technical advice – whether verbal, in writing or by way of trials – are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information currently provided – especially that contained in our safety data and technical information sheets – and to test products as to their suitability for the intended processes and uses. The application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.

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