

Product Data Sheet, January 2014

Makrolon® DX Line

Solid polycarbonate sheet for LED lighting



Your benefits:

- extreme high light transmission and high diffusivity at the same time
- extreme impact strength
- resistance to wide range of temperature

Solid **Makrolon® DX** sheets are polished polycarbonate diffuser sheets. **Makrolon® DX** is developed for applications based on LED light sources, which do not emit UV light. It offers a combination of high light transmission and light diffusion as well as an extreme impact strength which exceeds the physical properties of other thermoplastics. Makrolon® sheets resist temperatures of -100 to +120 °C.

Makrolon® DX warm is a diffuser sheet with a warm and pleasant color appearance, especially when backlit with cold white LEDs. **Makrolon® DX warm** enhances color rendering of light coming from red, green, blue LEDs and/or from the combination thereof.

Makrolon® DX cool is a diffuser sheet with a cool and fresh color appearance, even when the LEDs are in off mode.

Makrolon® DX-NR (warm/ cool) is a diffuser sheet with one side matt finish to prevent glare and reflections. The matt side contains also UV protection for improved weatherability.

Makrolon® DX-UV (warm/cool) is a diffuser sheet with one side UV protection for improved weatherability.

Makrolon® DX-NR and **Makrolon® DX-UV** are the perfect choice for a long service life because of their good weathering performance, backed up by a 10-year warranty. **Attention:** the sheet must be mounted with the UV protection layer facing the sun.

Applications:

Typical applications for **Makrolon® DX** diffuser sheets include all kinds of LED lighting fixtures and luminaires. The sheets offer protection against involuntary breakage and willful destruction therefore can also be applied in LED-based signage applications and street furniture where efficient lighting technologies are in use. **Makrolon® DX** sheets can be thermoformed, cold-curved and fabricated with ease.

	Test Conditions	Typical Values ⁽¹⁾	Unit	Test Method
PHYSICAL				
Density		1200	kg/m ³	ISO 1183-1
Water absorption saturation	water at 23°C	0.3	%	ISO 62
Water absorption equilibrium	23°C, 50 % RH	0.12	%	ISO 62
Refractive Index	Procedure A	1,586	-	ISO 489
MECHANICAL				
Tensile modulus	1 mm/min	2300	MPa	ISO 527-1,-2
Yield stress	50 mm/min	>60	MPa	ISO 527-1,-2
Yield strain	50 mm/min	6	%	ISO 527-1,-2
Nominal strain at break	50 mm/min	>50	%	ISO 527-1,-2
Flexural modulus	2 mm/min	2300	MPa	ISO 178
Flexural strength	2 mm/min	90	MPa	ISO 178
Charpy impact strength	23°C, unnotched	non-break	kJ/m ²	ISO 179-1eU
Charpy impact strength	23°C, 3 mm, notched	70P	kJ/m ²	ISO 179-1eU
Izod impact strength	23°C, 3.2 mm, notched	80P	kJ/m ²	ISO 180-A
THERMAL				
Vicat softening temperature	50 N; 50°C/h	144	°C	ISO 306
Thermal conductivity	23°C	0.2	W/(mK)	ISO 8302
Coefficient of thermal expansion	23 to 55°C	0.65	10 ⁻⁴ K	ISO 11359-1,-2
Temperature of deflection under load	1.8 Mpa	126	°C	ISO 75-1,-2
	0.45 Mpa	138	°C	ISO 75-1,-2
ELECTRICAL				
Electrical strength	1 mm	34	kV/mm	IEC 60243-1
Volume resistivity		1E14	Ohm.m	IEC 60093
Surface resistivity		1E16	Ohm	IEC 60093
Relative permittivity	100 Hz	3.1	-	IEC 60250
Relative permittivity	1 MHz	3	-	IEC 60250
Dissipation factor	100 Hz	5	10 ⁻⁴	IEC 60250
Dissipation factor	1 MHz	90	10 ⁻⁴	IEC 60250

⁽¹⁾ These values are measured on injection molded samples, and are not intended for specification purposes.

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Light Transmission:

Test Method according to CIE 130-1998, on a spherical photometer with a diameter of 1.5 m. Please ask us for more information. The stated values are typical values only.

Sample Thickness (mm)	Makrolon® DX warm		Makrolon® DX cool	
	1.5	3.0	1.5	3.0
τ_{D65}	76%	72%	65%	64%

Light diffusion:

According to DIN 5036-3 with a swivel-arm device using a luminance meter of class L (Fa. LMT) and a illuminance meter of class A (Fa. Czibula & Grundmann GmbH).

Sample Thickness (mm)	Makrolon® DX warm		Makrolon® DX cool	
	1.5	3.0	1.5	3.0
Half-power angle [°]	47°	60°	76°	75°
Light diffusion factor [σ]	58%	65%	79%	77%

Dimensions:

Thicknesses: **Makrolon® DX** line will be available in 1.5 mm and 3.0 mm

Sizes: **Makrolon® DX** line will be available in 2,050 x 1,250 mm

Upon request and quantity requirements, other dimensions can be offered.

Permanent Service Temperature:

The permanent service temperature without load is approx. 120 °C.

Fire Rating*:

Oxygen index (LOI) 27% ISO 4589-2 Method A.

Country	Standard	Rating	Thickness	Colour
Europe	EN 13501-1	B-s1-d0	1.5/ 3.0 mm	warm/cool
Germany	DIN 4102	B1	1.5/ 3.0 mm	warm/cool
UK	BS 476-7	Class 1Y	1.5/ 3.0 mm	warm/cool
USA**	UL 94	V2 V2 HB	1.5/ 3.0 mm 1.5 mm 3.0 mm	warm cool cool

* Fire certificates are limited in time and scope, always check if the mentioned certificate is valid for the purchased polycarbonate sheet type at the date of delivery. Polycarbonate sheets may change their fire behavior due to ageing and weathering. The indicated fire rating was tested on new / unweathered product in accordance with the indicated fire classification standards.

** Only indicative test result, no Yellow Card.

Glow Wire Flammability Tests:

Glow Wire Flammability Index (GWFI): 1.5/3.0 mm warm and cool: 850°C

Glow Wire Ignition Test (GWIT): 1.5/3.0 mm warm and cool: 875°C



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