VIAVI Solutions

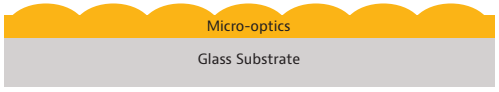
Application Note

Polymer-on-Glass Product Platform

Product Overview

VIAVI provides innovative micro-optics solutions that maximize system level performance while delivering the highest standards of quality, reliability and value. Our light shaping optics, including Engineered Diffusers®, set the standard in diverse applications such as 3D depth sensing, robotics, industrial, medical, automotive, and high-power laser applications.

We offer three polymer on glass (PoG) platforms, A, H and V, for custom optics Engineered Diffusers. Foundationally, PoG platforms consist of a glass substrate with a polymer diffuser or light shaping layer including micro-optics. Additional product functionality can be provided by adding anti-reflection (AR) coatings for improved transmission or transparent conductors, notably indium tin oxide (ITO) for eye safety needs on the exposed glass surface.



Polymer-on-glass Diffuser

Product Description

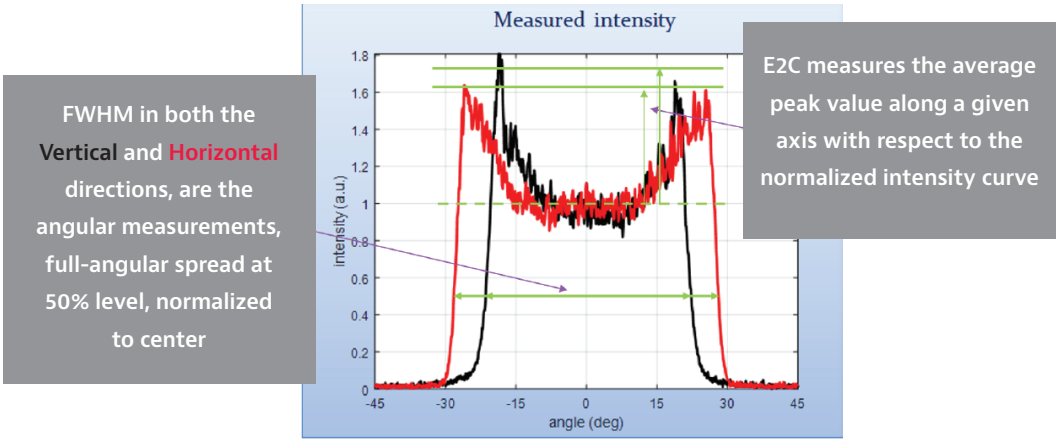
Through VIAVI expertise in integrating optical design with process expertise, and thin-film coatings, the PoG platforms can meet challenging custom optics requirements. This document outlines our standard catalog product capabilities however, improved performance offerings are available in collaborations with our high-volume customers.

Performance

Divergence Angle (Field of View)

Engineered Diffusers can be designed to shape light including, but not limited to linear, circular, square, rectangular, and asymmetrical outputs. The divergence angle or field of view (FOV) of output beam of our standard catalog PoG diffusers can be as large as 137° or as small as sub 1°. FOV is measured as the full width at half maximum (FWHM) of the intensity profile normalized to the center, in the horizontal and vertical direction and is specified as Divergence Angle with typical tolerance of ±5%. For reference, intensity profile provides distribution of light in angular space, and is the standard method for characterizing the performance of Engineered Diffusers. However, the output beam of an Engineered Diffuser can also be characterized with irradiance profile that illustrates light distribution as projected on a flat surface. Intensity profiles can be customized for flat-top, batwing, or gaussian profiles, for example. Our White Paper titled *Engineered Diffusers – Intensity vs Irradiance* provides additional technical details on intensity and irradiance profiles.

Measured far-field intensity along diffuser's main axis



Transmission

Transmission efficiency is a function of the PoG design and materials, and the wavelength of interest. A thorough analysis, including explanation of metrology, is provided in the white paper "*Transmission of Engineered Diffusers*" at the VIAVI website. Without AR coating, VIAVI PoG products have a transmission of >85% at 940 nm. In general, PoG products have a transmission range of 400 nm to 2000 nm based on the transmission characteristics of substrate and polymer materials.

Mechanical

Device size

Custom optics needs can be met with VIAVI PoG platforms for devices ranging from ~1 mm to 30 mm, larger is possible. For larger devices it is recommended to use 1.1 or 2.0 mm glass substrates. Smaller devices made with substrates as thin as 0.3 mm are most popular.

Device Thickness

Total thickness of the device is the distance from the bottom glass to the highest feature of the micro-optics. Thickness specification including tolerance range, considers thickness of the glass and polymer material. Each of A-PoG, H-PoG and V-PoG represent distinct manufacturing platforms with a tolerance range of total thickness.

Clear Aperture

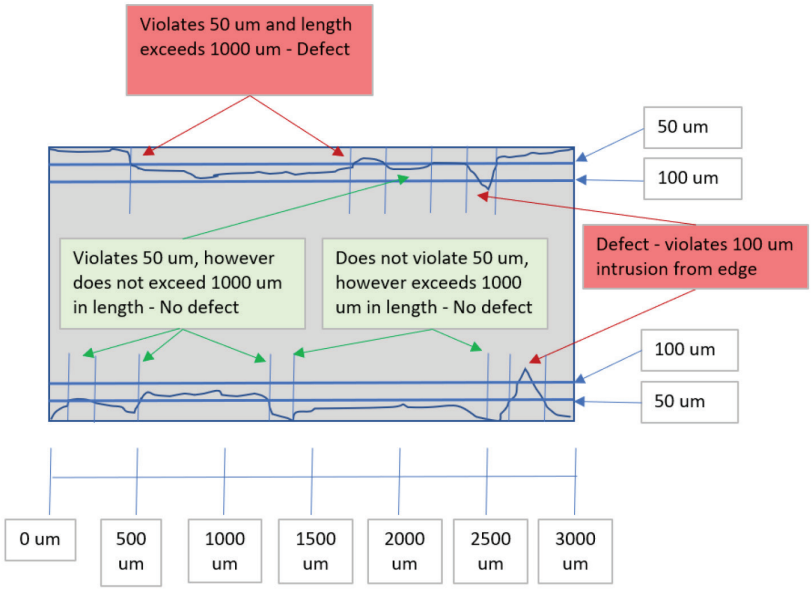
In most designs, the diffuser pattern spans the entire surface of the device. Nominally, the clear aperture is defined using the ISO 9211-1-2018 specification. Our definition of the clear aperture allows for a rim or border of 100 µm around the perimeter of the device. Up to 5% encroachment of the clear aperture area is allowed before considering the device a failure or a reject.

Backside Chip

Following are standard Edge Chip specifications for all PoG products:

- Substrate thickness <=1.1 mm
  - ≤100 µm INTRUSION FROM EDGE
  - ≤1000 µm LENGTH ALONG EDGE
  - ≤50 µm INTRUSION FROM EDGE DISREGARD
- Substrate thickness >1.1 mm, up to 2 mm thickness
  - ≤200 µm INTRUSION FROM EDGE
  - ≤1000 µm LENGTH ALONG EDGE
  - ≤100 µm INTRUSION FROM EDGE DISREGARD

The following picture graphically illustrates the interpretation of our standard edge chip specification guidelines.



Scratch Dig

VIAVI PoG standard products ship to scratch dig (S/D) spec of 80/50 and defined by MIL-PRF-13830B.

Reliability

PoG platforms are thoroughly tested to industry standard environmental tests. All platforms provide differentiation in different applications, with V polymer being the best performer for reliability demands. Test description and pass/fail criteria are shown below.

Test	Conditions	Failure Criteria	Metrology
Temp Humidity	· 85°C/85%RH · Up to 1000 hours	· Adhesion per clear aperture criteria · 5% change in FWHM; 20% in E2C	· Microscopy · Scatter 1D or 2D
Temp Cycle	· -40°C to 85°C, 5 min ramp, 30 min dwell · Up to 1000 cycles	· Adhesion per clear aperture criteria · Glass failure per clear aperture criteria · 5% change in FWHM; 20% in E2C	· Microscopy · Microscopy · Scatter 1D or 2D
Low Temperature Hold	· -40°C · Up to 1000 hours	· Adhesion per clear aperture criteria · 5% change in FWHM; 20% in E2C	· Microscopy · Scatter 1D or 2D
High Temperature Hold	· 125°C · Up to 1000 hours	· Adhesion per clear aperture criteria · 5% change in FWHM; 20% in E2C	· Microscopy · Scatter 1D or 2D
Reflow J-STD-020E to MSL-1	· Ramp to 260°C following 200 hrs moisture · Preconditioning at 85°C/85%RH	· Adhesion per clear aperture criteria · 5% change in FWHM; 20% in E2C · Yellowing* / transmission	· Microscopy · Scatter 1D or 2D · Scatter and Integrated Sphere

*If applicable, based on wavelength

Handling

Physical handling is the number one cause of surface and performance defects for optical products. Every contact point in the cleaning, manufacturing, inspection, shipping, receiving, and installation process steps introduces a risk of damage to the sensitive components. Following are guidelines for handling light-shaping optics products produced by VIAVI Solutions to reduce the likelihood of damaging the product.

- Always use gloves when handling light-shaping optics to protect the component from chemicals present on bare skin.
- Handle the optic by the edges to avoid contact with the optical surface. To remove particles, blow off the surface, ideally with clean, dry compressed air or nitrogen. If using an inert dusting gas, follow the manufacturer's directions for use, being sure to start the flow of gas with the nozzle directed away from the component to prevent the deposition of the inert gas propellant on the surface.
- Do not use solvents on the diffusers (this can lead to a failure of the optic).

To handle small light-shaping optics, use optical or vacuum tweezers:

- Optical tweezers are tipped with a soft polymer to prevent damage to the component. When using tweezers, only pick up the optical component from the edges – NEVER grasp the optic on the optical surfaces to avoid damage. When picking up a die from the edges, use care to ensure the component is not squeezed too tightly to prevent the risk of chipping, bending, or breaking. Tweezers should be inspected for contamination and cleaned and dried often. Vacuum tweezers use suction to hold the component. Only use vacuum on the backside (smooth side) of the optic. Ensure that the soft suction tip is clean and dry before use.

Product Platform Comparison

VIAVI experts will help you determine which platform is best for your application. A comparison is shown below.

	Polymer on Glass Platform		
	Polymer A	**Polymer H**	**Polymer V**
Design: Max FOV	✓ ✓ ✓	✓ ✓ ✓	✓ ✓
Transmission* %	✓ ✓	✓ ✓	✓ ✓
Wavelength Range	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Reliability		✓ ✓	✓ ✓ ✓
RoHS Compliant	✓	✓	✓
REACH Compliant	✓	✓	✓

*Transmission without backside AR coating.

Details are provided in the table below:

				Polymer Platform Specification			
	Requirement	**Description**	**Units**	**Polymer A**	**Polymer H**	**Polymer V**	**Reference**
Mechanical	Substrate	Glass substrate	N/A	Schott D263T eco and Borofloat			Substrates 0.2 mm to 2.0 mm
	Die Size	Dicing tolerance	mm	±0.05			
	Device Thickness, Tolerance	Total thickness	mm	X =±0.100 mm	X = ±0.075 mm	X = +0.04 / - 0.02 mm	
	Clear Aperture	Active diffuser area	um	Exclusive of 100um border			ISO 9211-1-2018
	Backside Chip Depth, max	Chip length perpendicular to edge	um	100			For glass <= 1.1 mm
	Backside Chip Length, max	Chip length parallel to edge	um	1000			For glass <= 1.1 mm
	Scratch / Dig, S/D	Nominal surface defect specification		80/50			MIL-PRF-13830B
Performance	FOV	Maximum angle	deg (°)	~137°	~137°	~120°	Per intensity measurements at 940 nm
	FOV Tolerance	Standard tolerance to nominal FOV target	%	±5%			Per intensity measurements at 940 nm
	Transmission	Measured at 940 nm, collimated source	%	Typically >85%			White paper
	Transmission Range	Transmission wavelength and diffuser design dependent	nm	400 - 2000			White paper
	Laser Induced Damage Threshold	Limit at which the device is damaged as defined by power/area and wavelength	W/m2	Design and application dependent			
Reliability	Temp Humidity	85°C / 85%RH	Hours	N/A	150	1000	Reliability report
	Temp Cycle	-40°C to 85°C, 5 min ramp, 30 min dwell	Cycles	N/A N/A	>=50, Typical Design Dependent	>=250, Typical Design Dependent	Reliability report
	Low Temperature Hold	-40°C	Hours	N/A	1000	1000	Reliability report
	High Temperature Hold	125°C	Hours	N/A	1000	1000	Reliability report
	Reflow	Ramp to 260°C following 200 hrs moisture preconditioning at 85°C / 85%RH	Cycles	N/A	5	5	J-STD-020E to MSL-1 Reliability Report
Compliance	REACH	Registration, Evaluation, Authorization of Chemicals	NA	Meets REACH standards			Reference REACH standard
	RoHS	Restriction of Hazardous Substances	NA	Meets RoHS standards			Reference RoHS standard

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