

Packaged TLens® Silver

Next Generation AF-solution

General Description

The TLens® Silver can be mounted on an existing barrel-type fixed focus camera module, and is designed to support high picture quality and resolutions from 3MP and upwards, and is compatible with up to 1/3" sensor sizes. The Packaged TLens® has been made to ease the integration.

TLens® Silver is not just a replacement of traditional VCM (Voice Coil Motor) technology for Auto Focus, it enables a range of totally new experiences, use cases and ways to build innovation due to;

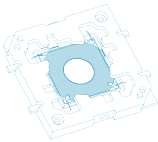
Extremely quick autofocus – response time <1 ms, enables to take several

images and combine to one, - “All-in-Focus” or grab the moment with instant focus far beyond competing *technologies*.

Constant field of view – the zoom effect is not seen when focusing is changing, unlike for VCM. This will give a smooth and accurate focus during image and video recording.

High optical axis stability – by design TLens® has high optical axis stability and is not affected by gravity, thermal- and mechanical shock, being one of the challenges in using VCM. This imply no need for complex calibration procedures, gives stable behaviour with respect to changing environment over the lifetime, resulting in simplified manufacturing processes and higher image quality over time.

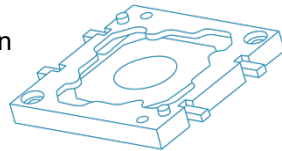




Extremely low power consumption, < 1 mW – important for new applications in both smartphones and wearables. The low power consumption also means that focusing will not increase the temperature of the image sensor resulting in better image quality.

More efficient manufacturing of camera module with AF – TLens® will enable efficient camera module manufacturing resulting in better yield at camera module level by minimising dust contamination compared to

VCM which keeps open access to IR Filter/image sensor. Further the integration of camera module with TLens® can easily be fully automated resulting in better yield and more cost effective processes.



Ease integration of camera in phone – the small footprint makes a TLens® based camera easier to fit in the phone – front and back. Also due to no magnets and coils the interference issues will disappear using TLens®.

Enabler for Dual/multi Camera implementation – the eco-system is getting ready for multi camera systems. In this context TLens® will be a key enabler. Due to its small footprint the cameras can be placed close together (good for high resolution, extended dynamic range, optical zoom etc.), the constant field of view and high optical axis stability (improve image stitching/bracketing computation process). Further no electromagnetic cross talk between cameras, low power consumption as well as the instant focus will improve inherently the multi-camera system performance

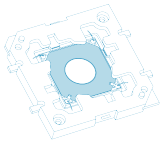
Key Characteristics

- Response time down to <1ms
- Ultra-low power consumption <1mW
- Small footprint 3.2mm x 3.2mm
- Aperture of 1.55mm
- Focus distance from infinity down to 10cm

Potential application areas

- Camera Phones (front and back)
- Wearables
- Tablet PCs
- HD Video Camera
- Drones
- Handheld Devices
- Barcode Readers





Packaged TLens® description

The package TLens® has been designed in order to facilitate the integration of a TLens® on a fixed focus camera module. It has been designed in order to guarantee optimum TLens® performance over the operating temperature range, storage conditions as well as drop test according to most demanding mobile phone specifications.

The package TLens® is cost effective since it has been integrated in the TLens® manufacturing processes and is minimizing the overall handling steps of TLens® integration on a camera module.

The package TLens® will be 100% functionally tested (focusing range, optical quality) by

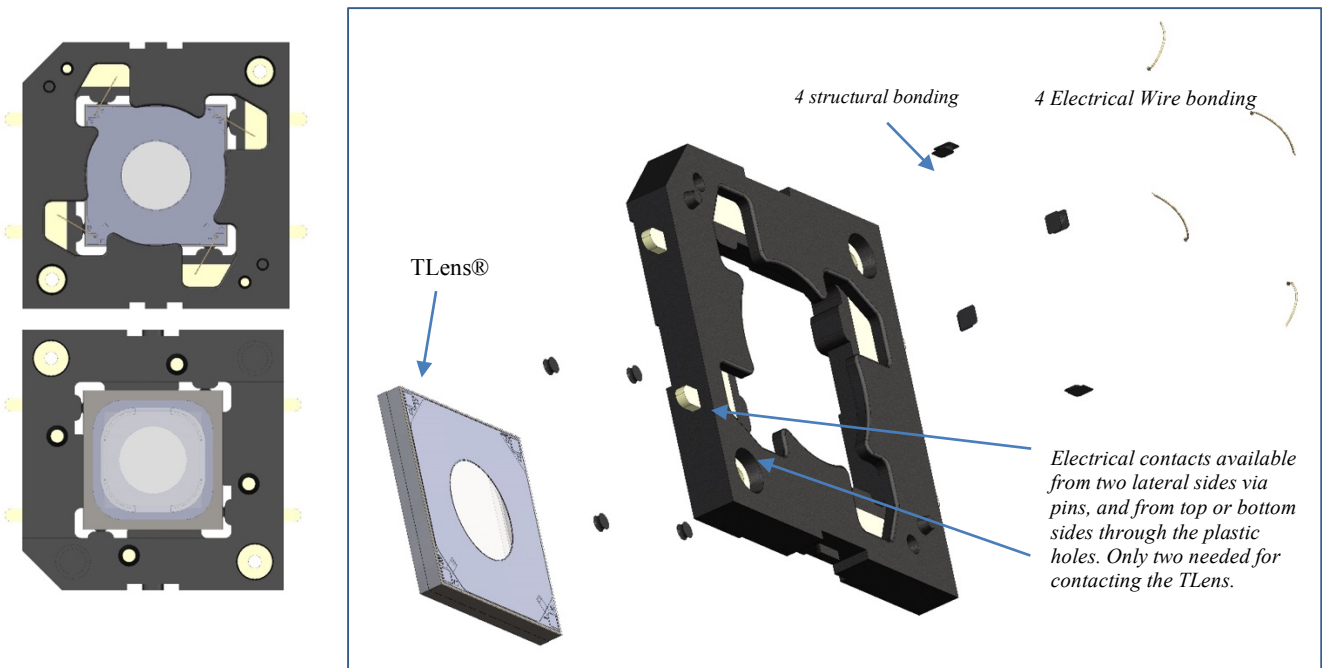
poLight resulting in improved manufacturing yield of camera module.

The package TLens® is made of a metal insert plastic over molding, wire bonding for electrical connections and structural bonding for mechanical performances.

The package TLens® interfaces with the camera module are:

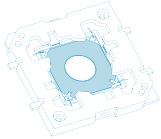
- Plastic feature for auto centring on camera module
- Top, bottom and side metal contacts to allow easy electrical contact to FPC or other camera module electrical contact.

The packaged TLens® can come with ESD and stray light cover that can be assembled at camera module level as an option.



left) Packaged TLens® top and bottom view, **right)** Packaged TLens® exploded view





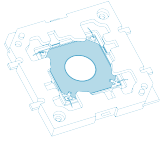
Specifications at room temperature (25°C) unless otherwise specified.

Description			Performances		
1. Mechanical specification	<i>Symb</i>	<i>Unit`</i>	Min	Typ	Max
1 Length of Packaged TLens® (contact pins excluded)	<i>TLL</i>	<i>mm</i>		6	
2 Width of Packaged TLens® (contact pins excluded)	<i>TLW</i>	<i>mm</i>		6	
3 Total thickness of Packaged TLens®	<i>TLT</i>	<i>mm</i>		0.6	
4 Build thickness on Camera module		<i>mm</i>		0.45	
5 Centring accuracy < +/-0,05mm		<i>mm</i>			0.05
2. Optical specification	<i>Symb</i>	<i>Unit`</i>	Min	Typ	Max
1 Useful aperture (UA) diameter - Front window	<i>FUA</i>	<i>mm</i>		1.55	
2 Useful aperture (UA) diameter - Back window	<i>BUA</i>	<i>mm</i>		2.05	
3 Imperfections in useful aperture area	<i>IMP</i>	<i>ISO10110</i>			4x0.063
4 Wavefront error (RMS) over useful aperture	<i>WFE</i>	<i>nm</i>		30	50
5 Average transmittance (spectral range 400-650nm)	<i>T</i>	<i>%</i>	94%		
3. Actuator Specification	<i>Symb</i>	<i>Unit`</i>	Min	Typ	Max
1 Minimum optical power	<i>PL</i>	<i>m⁻¹</i>		-4	-1
2 Maximum optical power	<i>PH</i>	<i>m⁻¹</i>	9	12	
3 Slope	<i>SL</i>	<i>m⁻¹/V</i>		TBD	
4 Integral linearity (Max error from best linear fit)	<i>IntL</i>	<i>m⁻¹</i>		TBD	
5 Differential Linearity (measured on 1V step)	<i>DifL</i>	<i>m⁻¹/V</i>		TBD	
6 Hysteresis (over the full voltage range)	<i>Hyst</i>	<i>m⁻¹</i>			5
7 Response Time – 40V step	<i>Rt</i>	<i>ms</i>			5
8 Settling time - 0.5V step	<i>St</i>	<i>ms</i>			1
9 TLens® equivalent Capacitance @ 0V	<i>C</i>	<i>nf</i>		35	50
4. Operating conditions	<i>Symb</i>	<i>Unit`</i>	Min	Typ	Max
1 Operating voltage (top electrode – bottom electrode)*	<i>Vop</i>	<i>V</i>	-10		40
2 Duty cycle – operating voltage cycle	<i>DC</i>	<i>%</i>			TBD
3 Applied average voltage (short term – within 1 hour)	<i>Vav</i>	<i>V</i>			TBD
4 Operating temperature	<i>Top</i>	<i>°C</i>	-10		60
5 Relative humidity	<i>RH</i>	<i>%</i>			85
5. Maximum ratings (may affect performance and reliability)	<i>Symb</i>	<i>Unit`</i>	Min	Typ	Max
1 Storage temperature	<i>TS</i>	<i>°C</i>	-40		80
2 Applied voltage (top electrode – bottom electrode)*	<i>Vmax</i>	<i>V</i>	-15		50
3 Applied current	<i>Imax</i>	<i>mA</i>			1

*Negative voltage is usually obtained by setting the top electrode at zero potential and the bottom electrode at a positive potential

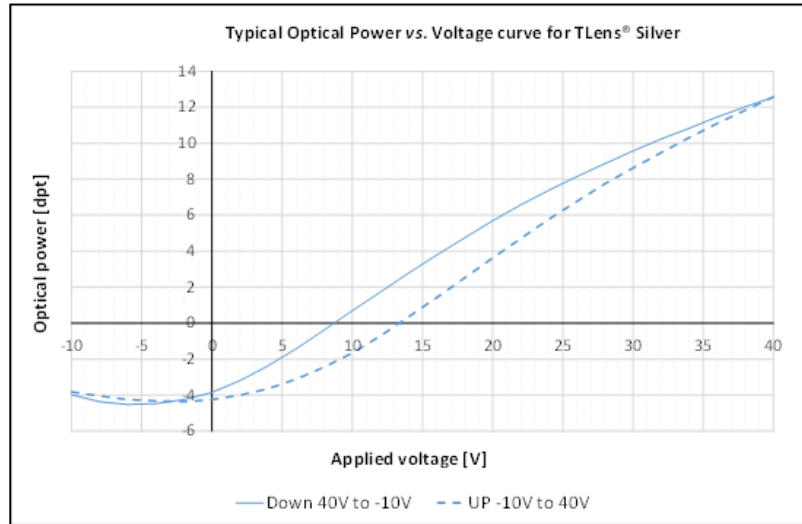
Stresses beyond the listed Maximum ratings (see section 5 above) may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Operating the device outside the given Operating condition (see section 4 above) may effect the device reliability.



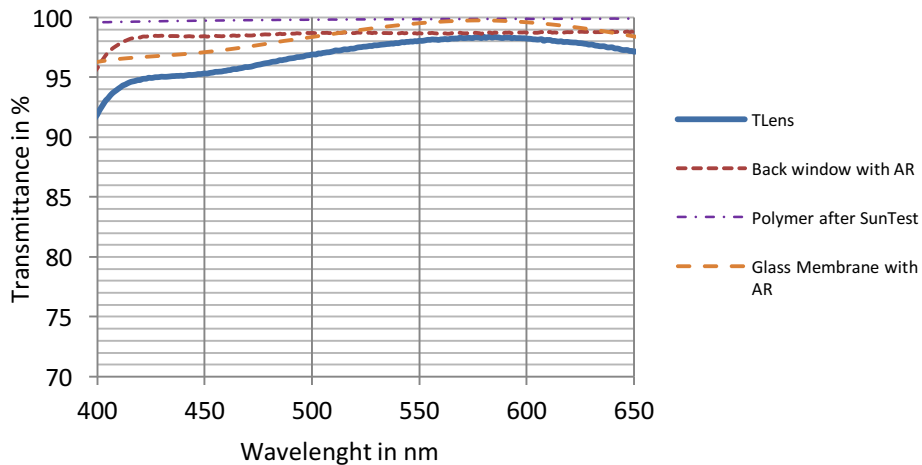


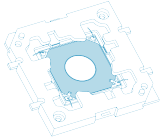
Auto Focus Actuator

The following graph shows a typical Optical Power (OP) versus voltage curve for the TLens® Silver at room temperature. The OP response is shown for both increasing and for decreasing voltage.



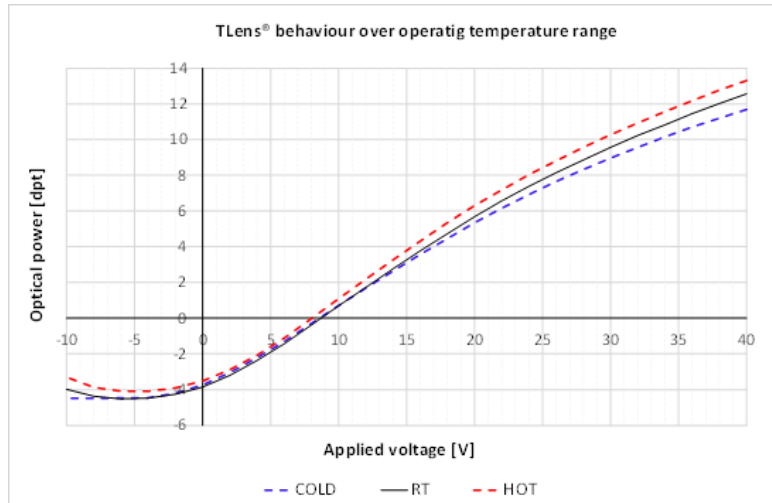
The following curve gives the typical transmittance of a TLens®, as well as the contributor of the different components making the TLens®.





Thermal Behaviour of TLens®

The graph below shows typical temperature behaviour of the packaged TLens®. “RT” (room temperature) refers to operating at 25 °C, “COLD” is the curve for operation at -10°C, and “HOT” for 60 °C.



The dependency of the TLens® output signal on the temperature can be affected by the chosen assembly method. Care needs to be taken to minimize the impact of external mechanical stress on the TLens®.

Information on package material for integration on camera module:

- Plastic: LCP (liquid crystal polymer)
- Electrical contact: Cu with Ni and Au plated

CAD and Optical Model

Can be provided on request.

Driver

Please, contact poLight for specifications and recommendations.

Ordering Information

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Part Number	Description
PAF.15.P.001	Packaged TLens® Silver

poLight AS reserves the right to alter without notice the datasheet, hereunder but not limited to the specification, design, price or conditions of supply of the product.

