



# TCZEL23056 | DATASHEET

Telecentric zoom lens for 2/3" sensors with integrated liquid lens, magnification range from 0.180x to 0.550x



### KEY ADVANTAGES

#### Maximum versatility

Possibility to adjust both the magnification and the working distance

#### Reduced wear

No moving optical mechanical parts

#### Faster than traditional zooms

Optotune® liquid lens technology allows to operate in few milliseconds

The **TCZEL** series features telecentric lenses characterized by an extremely innovative optical design that integrates two Optotune® liquid lenses whose synergy allows you to control both the magnification and the working distance. These lenses therefore combine the accuracy of telecentric lenses, the advantages of zoom optics and the extreme versatility of liquid lenses.

### SPECIFICATIONS

#### Optical specifications

Magnification range	(x)	0.180 - 0.550
Magnification ratio	(x)	3
Image circle	(mm)	11
Max sensor size		2/3"
Working distance range <sup>1</sup>	(mm)	115 - 155

#### liquid lens specifications

Number of lenses		2
Liquid lens model		Optotune EL-16-40-20D
Temperature sensor		Yes
Focal power mode		Yes
Response time <sup>7</sup>	(ms)	5
Setting time <sup>7</sup>	(ms)	25
Current range	(mA)	-500 to +500
Repeatability using focal power mode	(dpt)	±0.05 small steps ±0.10 large steps
Lifecycles 10%-90% sinusoidal	(s)	>1,000,000,000
Connector		HR10A-7R-6PB

#### Mechanical specifications

Mount		C
Phase adjustment <sup>8</sup>		Yes
Length <sup>9</sup>	(mm)	249.3
Front diameter	(mm)	80.0
Mass	(g)	967

#### Environment

Operating temperature	(°C)	0-40
Storage temperature	(°C)	0-50
Operating relative Humidity	(%)	20-85, non condensing

#### Installation

Indoor use only

<sup>1</sup> Working distance: distance between the front end of the mechanics and the object. Set this distance within ±3% of the nominal value for maximum resolution and minimum distortion.

<sup>2</sup> Working *f/N*: the real *f/N* of a lens in operating conditions.

<sup>3</sup> Maximum angle between chief rays and optical axis on the object side. Typical (average production) values and maximum (guaranteed) values are listed.

<sup>4</sup> Percent deviation of the real image compared to an ideal, undistorted image. Typical (average production) values and maximum (guaranteed) values are listed.

<sup>5</sup> At the borders of the field depth the image can be still used for measurement but, to get a very sharp image, only half of the nominal field depth should be considered. Pixel size used for calculation is 3.45 μm.

<sup>6</sup> Object side, calculated with the Rayleigh criterion with λ= 520 nm

<sup>7</sup> Typical at 30°C, 0 to ±250 mA step.

<sup>8</sup> Indicates the availability of an integrated camera phase adjustment feature.

<sup>9</sup> Measured from the front end of the mechanics to the camera flange.

### COMPATIBLE PRODUCTS

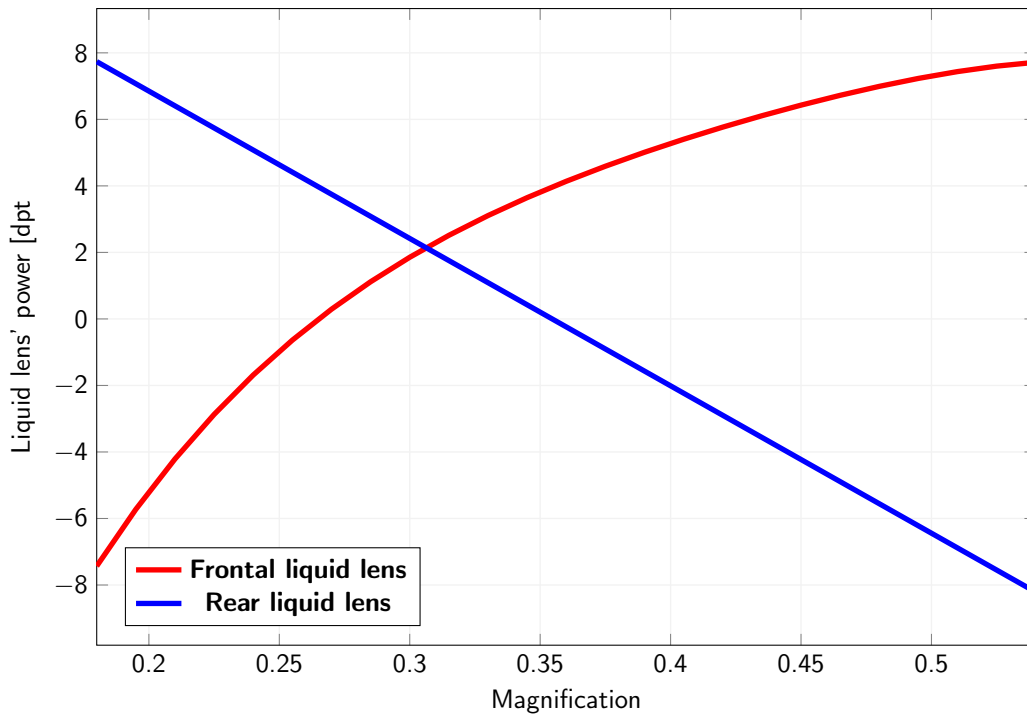
Full list of compatible products available [here](#).



A wide selection of innovative machine vision components.

All product specifications and data are subject to change without notice to improve reliability, functionality, design or other. Photos and pictures are for illustration purposes only. Data are reported by design, actual lens performance may vary due to manufacturing tolerances.

MAGNIFICATION AND LIQUID LENSES' POWER, WD 135MM

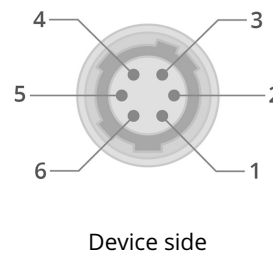


COMPATIBLE CONTROLLER

The TCEL tunable lens must be controlled by a suitable lens driver. Hirose cables and Liquid Lens driver are sold separately. Only the following part numbers are considered fully compatible with TCZEL23056:

- **CBGPIO6PMF-3M**, 6 Pin Hirose Male - Female moulded connector cable, 3 m.
- **RT-EL-E-4i**, USB Controllers for liquid lens modules, industrial version.

CONNECTOR PINOUT



Pin	Description
1	Control current +
2	Control current -
3	GND
4	Power
5	I <sup>2</sup> C SCL
6	I <sup>2</sup> C SDA

ADDITIONAL NOTE

Performances guaranteed when used with vertical optical axis; when used with horizontal optical axis performances drop due to gravity induced aberrations of the liquid lens.

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**MAGNIFICATION 0.180X, WORKING DISTANCE 135MM**

**SPECIFICATION**

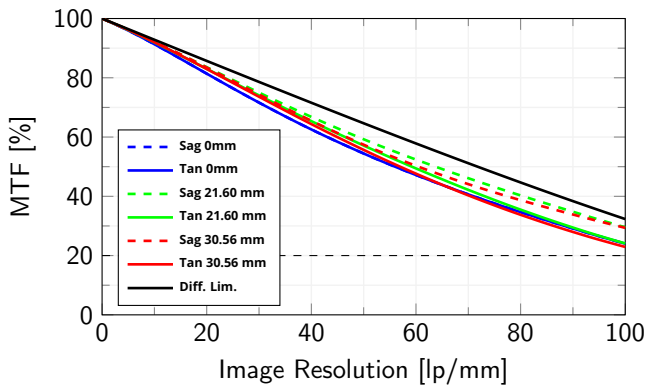
**Optical specifications**

wF/N <sup>2</sup>		9.0
Telecentricity typical (max) <sup>3</sup>	(°)	< 0.3
Distortion typical (max) <sup>4</sup>	(%)	< 0.3
Field depth <sup>5</sup>	(mm)	14.38
Resolution (max) <sup>6</sup>	(µm)	32

**FIELD OF VIEW**

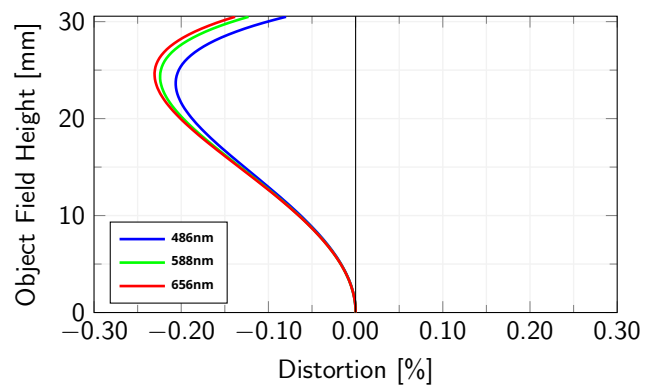
Sensors	(mm x mm)
1/3" (4.8 x 3.6 mm x mm)	26.67 x 20.00
1/2.5" (5.70 x 4.28 mm x mm)	31.67 x 23.78
1/2" (6.4 x 4.8 mm x mm)	35.56 x 26.67
1/1.8" (7.13 x 5.33 mm x mm)	39.61 x 29.61
2/3" (8.50 x 7.09 mm x mm)	47.22 x 39.39

**Image Resolution**



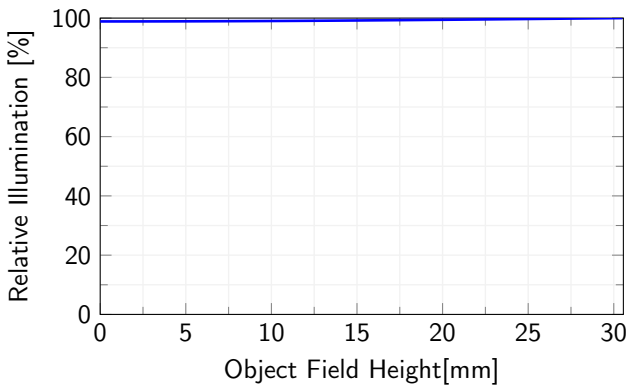
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm

**Distortion**



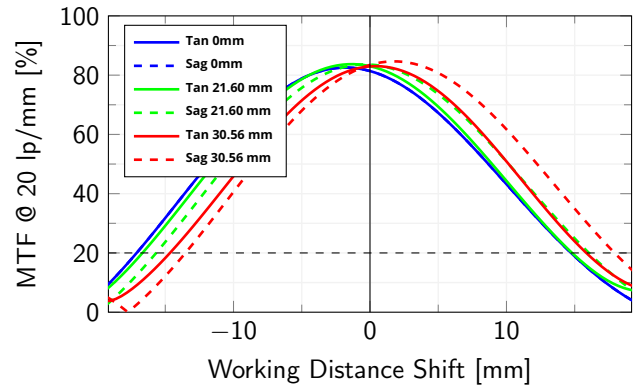
Object Field Height vs. Distortion, from the optical axis to the corner of the field of view

**Relative Illumination**



Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view

**Depth of Field**



Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm

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**MAGNIFICATION 0.550X, WORKING DISTANCE 135MM**

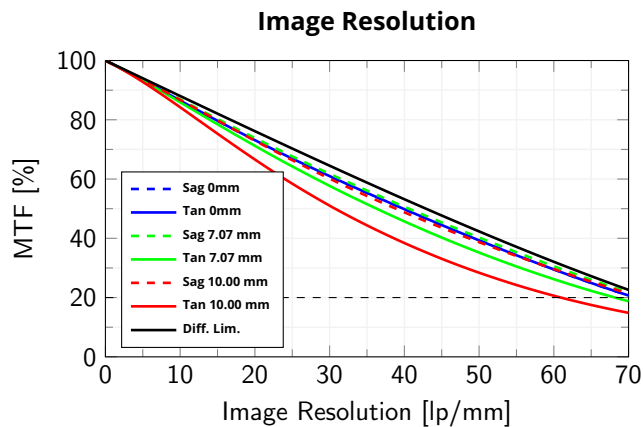
**SPECIFICATION**

**Optical specifications**

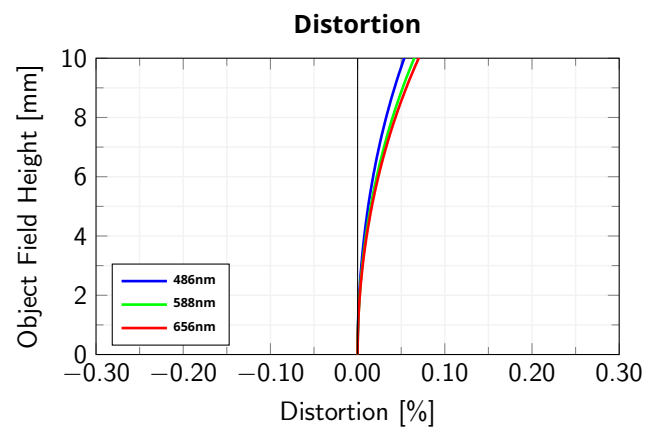
wF/N <sup>2</sup>		16.0
Telecentricity typical (max) <sup>3</sup>	(°)	< 0.3
Distortion typical (max) <sup>4</sup>	(%)	< 0.3
Field depth <sup>5</sup>	(mm)	2.74
Resolution (max) <sup>6</sup>	(μm)	18

**FIELD OF VIEW**

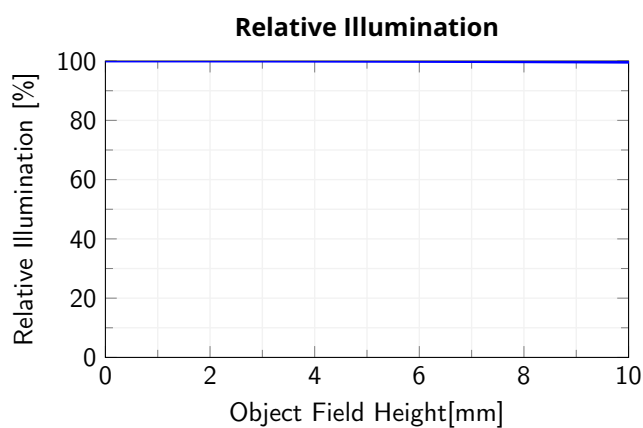
Sensors	(mm x mm)
1/3" (4.8 x 3.6 mm x mm)	8.73 x 6.55
1/2.5" (5.70 x 4.28 mm x mm)	10.36 x 7.78
1/2" (6.4 x 4.8 mm x mm)	11.64 x 8.73
1/1.8" (7.13 x 5.33 mm x mm)	12.96 x 9.69
2/3" (8.50 x 7.09 mm x mm)	15.45 x 12.89



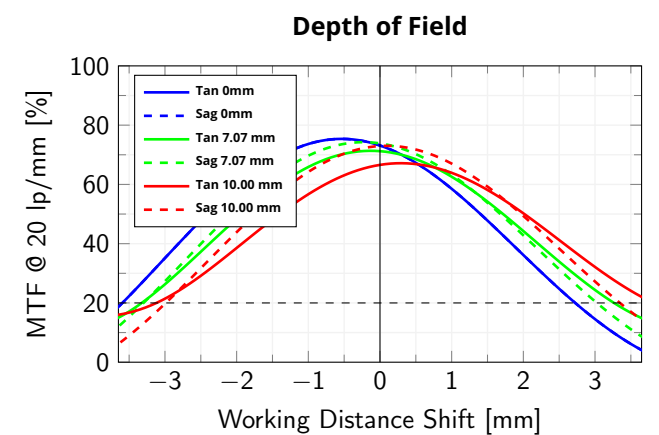
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm



Object Field Height vs. Distortion, from the optical axis to the corner of the field of view



Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view



Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm

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