



# Theia<sup>®</sup>

TECHNOLOGIES

## TL410 lens family 4K Resolution Day/Night lenses up to 1/1.7" sensors

- ✓ Ultra high resolution for 4K cameras, up to 12.4 megapixel
- ✓ Available with P-iris for precise aperture control or DC autoiris
- ✓ Fully motorized with zoom, focus, iris. Some models include IR cut, and limit switches
- ✓ Optional motor control board available for easy integration
- ✓ IR corrected for true Day/Night cameras
- ✓ Compact design to fit into domes as small as 4" mini-dome size
- ✓ CS-mount or D25 mount
- ✓ Used for sensor sizes 1/2.5", 1/2.3", 1/2", 1/1.8", and up to 1/1.7" (Sony IMX178, Sony IMX226 for example)

### TL410 lens specifications

Focal length (FL)	4-10mm
Image circle	Ø9.4mm at FL 4mm
Resolution	12.4 megapixel
F/#	F/1.4 @ 4mm – F/2.4 @ 10mm to close
Focus Range	0.5m to infinity
IR Correction	440nm – 950nm (Day/Night)
Lens length (TTL)	< 64mm TTL
Back focal length (BFL)	8.4mm (in air)
Chief ray angle (CRA)	< 7°
Geometric distortion	< 61% at 4mm, < 8% at 10mm
Relative illumination	>45%
Lens transmission	>80%
Operating temperature	-20C to 60C (<70% humidity, non-condensing)
Storage temperature	-30C to 70C (<90% humidity, non-condensing)

### Field of view for sensor sizes

Sensor size	1/1.7"	1/1.8"	1/1.8" 4K*	1/2"	1/2.3"	1/2.5"
Horizontal	112° - 44°	110° - 43°	110° - 43°	93° - 37°	90° - 36°	83° - 33°
Vertical	81° - 33°	71° - 29°	52° - 21°	68° - 28°	67° - 27°	60° - 25°
Diagonal	149° - 55°	139° - 52°	126° - 48°	120° - 46°	117° - 45°	106° - 42°

\*4K format = 4000 x 2000 pixels



Visit Theia's website for more information about the lenses.

## Motor specifications

### Focus, zoom motors

Drive	Stepper motor 2 phase bipolar drive
Operation voltage	3.3V (range 2.6~4.8V)
Maximum motor temperature*	Do not let motor temperature exceed 92°C
Coil resistance	28.5Ω (±7%)
Zoom number of steps	1:2025
Zoom speed range	4073 steps between hard stops
Zoom cam rotation	600pps to 1000pps
Focus number of steps	85°
Focus speed range	9354 steps between hard stops
Focus cam rotation	196°

### Iris motor (p-iris)

Drive	Stepper motor 2 phase bipolar drive
Operating voltage	4V (+/-1)
Number of steps	75
Basic step angle	18°
Maximum response freq.	200 pps
Coil resistance	30Ω (each phase)

### Iris motor (DC autoiris)

Drive	DC
Operation voltage	3V (2.5~5.0V)
Max current consumption	22mA
Drive coil resistance	190Ω
Damper coil resistance	855Ω

### IR cut (on some models)

Drive	DC
Operating voltage	4.0V
Drive coil resistance	130Ω
Connector type	Housing: Molex 51021-0200 Terminal: Molex 50058-8000

### IR cut optical versions

The IR cut will switch between two filters. Most lenses use visible bandpass (405-650nm) and clear glass (405-1100nm).

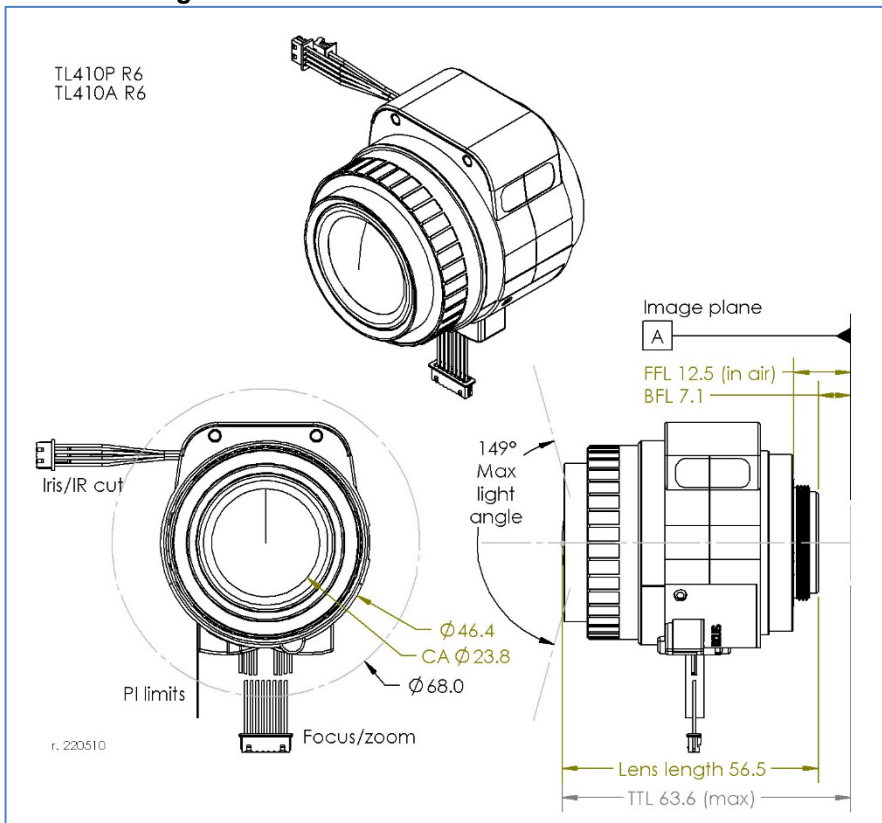
There are some models that include filters for 940nm (long pass >880nm) with either visible or clear glass alternate filter.

### Limit switches (on some models)

Type	Photo interrupter Phototransistor (open emitter)
Part model	Sharp GP1S396HCPSF
Operating voltage	3.3V
Output level	>2.2V HIGH <0.6V LOW
Connector type	FPC cable

Limit switches allow the driver to find the home position without driving the motor against the hard stop. From this home position, the motor steps can be monitored to prevent the motor from hitting the hard stop on the opposite side.

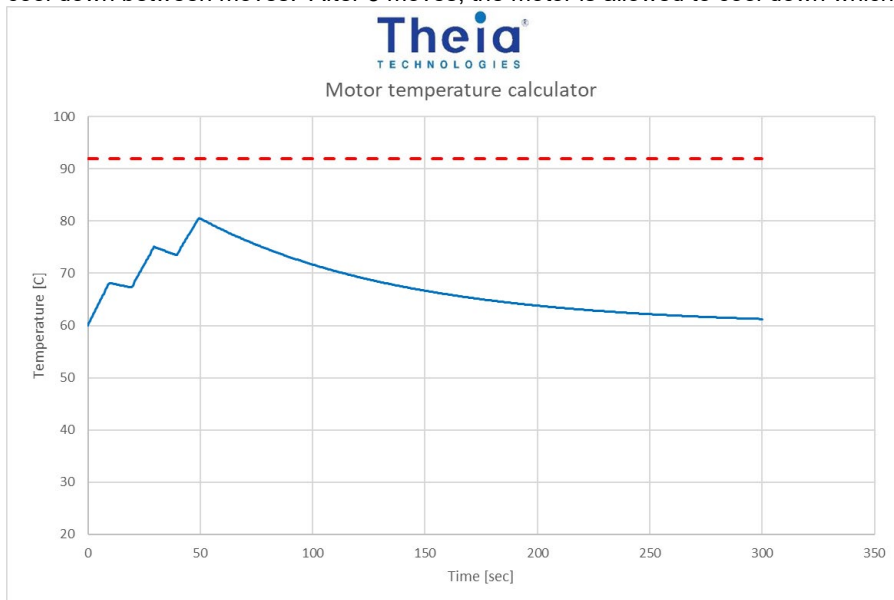
## Typical lens drawing



CAD models can be downloaded from [TheiaTech.com/410CAD](http://TheiaTech.com/410CAD)

## Motor temperature model

The example below shows 60C ambient temperature and 3.5V motor. The motor is driven for 10 seconds with 10 seconds cool down between moves. After 3 moves, the motor is allowed to cool down which takes about 4 minutes.

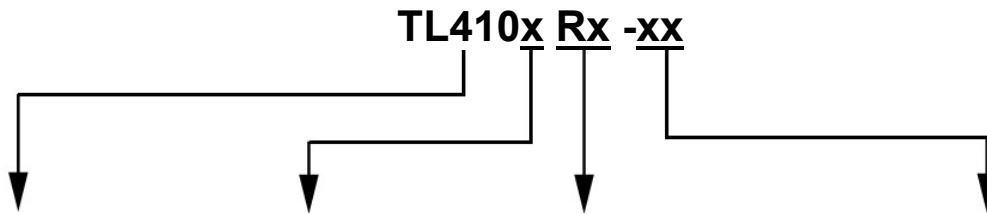


Motor temperature calculator  
[TheiaTech.com/calculators](http://TheiaTech.com/calculators)

**\*\*Zoom and focus motor positions may be affected by backlash and lost steps during movement.** Lost steps are affected by the driving conditions. It is best to drive the motor between 600pps and 1000pps with 4-12 steps of acceleration/deceleration. Acceleration is especially helpful at higher driving speeds. Within these limits, the lost steps are tested to be <40 steps per full zoom range and <30 steps per full focus range.

## Lens models

The options listed in the table below may or may not be available. More detailed specifications can be found on Theia's website for the available lens models. Please visit [www.theiatech.com](http://www.theiatech.com) to learn more about our other lens options.



Lens	Iris type	Motor configuration	Mount type
TL410	A: DC autoiris P: P-iris	R3 R4 R5 R6	(blank): CS mount CS: CS mount D25: Ø25mm board mount

<i>Theia</i> ® PN	Varifocal	LOT® technology	Mount type	Mount slip ring	Iris type	CCTV iris con.	Molex iris con.	IR corrected (day/night)	IR cut switch	Zoom motor	Focus motor	PI limits	Focal length	MP rating	f/#	Image circle	Biggest sensor format	MOD [m]	Lens Length (to mount)	Lens Length (TTL)	Weight [g]
TL410A R6	✓		CS	✓	A		✓	✓	✓	✓	✓	PI	4-10	12 (4K)	f/1.4	9.4	1/1.7"	0.5	51.5	64	78
TL410A R5	✓		CS	✓	A	✓			✓	✓	PI	80									
TL410A R4	✓		CS	✓	A		✓	✓	✓	✓		77									
TL410P R6	✓		CS	✓	P		✓	✓	✓	✓	PI	75									
TL410P R6 25	✓		D25		P		✓	✓	✓	✓	PI	78									
TL410P R5	✓		CS	✓	P	✓			✓	✓	PI	77									
TL410P R4	✓		CS	✓	P		✓	✓	✓	✓		74									
TL410P R3	✓		CS	✓	P	✓			✓	✓		76									
<b>Related versions without motorized zoom and focus</b>																					
SL410M	✓		CS	✓	M		✓						4-10	12 (4K)	f/1.4	9.4	1/1.7"	0.5	51.5	64	72
SL410P	✓		CS	✓	P	✓						75									
SL410A	✓		CS	✓	A	✓						78									
ML410M	✓		CS	✓	M		✓						6-10		f/1.6	11.0	2/3"		46.5	64	67
ML610P	✓		C	✓	P		✓					74									
ML610M	✓		C	✓	M		✓					70									

For more information contact  
Theia Technologies

info@TheiaTech.com  
[www.TheiaTech.com](http://www.TheiaTech.com)  
+1-503-570-3296

## Revisions

Version	Change	Reason
220401	Templated spec sheet	Family spec sheet can be reduced for each lens model to simplify spec sheet
220516	Alternate lens table	Updated to separate non-motorized versions