

TL936 lens family Motorized Telephoto Day/Night 4K Compatible Megapixel Lens



9mm



36mm

- ✓ Compatible with 4K cameras with 5+ megapixel resolution for demanding applications
- ✓ Fully motorized with zoom, focus, and iris. Some models with IR cut and limit switches
- ✓ 4x zoom: 9-36mm for long reach and field of view optimization
- ✓ Optional motor control board available for easy integration
- ✓ Available with P-iris for precise aperture control or DC autoiris
- ✓ IR corrected for true Day/Night cameras
- ✓ Compact design (< 62.5mm TTL) to fit into domes as small as 4" mini-dome size
- ✓ CS-mount
- ✓ For 1/3", 1/2.7" HD, 1/2.5" and 1/2.3" 4K* sensors

TL936 lens specifications

Focal length	9-36mm
Image circle	Ø9.2mm at FL 9mm
Resolution	5+ megapixel
F/#	F/1.5 to close
Focus range	2.5m to infinity
IR Correction	440nm – 950nm (Day/Night)
Lens length (TTL)	<62.5mm (TTL)
Back focal length (BFL)	8.7mm (in air)
Relative illumination	>30%
Lens transmission	>80%
Operating temperature	-20C to 60C (<70% humidity, non-condensing)
Storage temperature	-20C to 70C (<90% humidity, non-condensing)
CS mount slip range	320°

Field of view for sensor sizes

Sensor size	1/3"	1/2.7" HD	1/2.5"	1/2.3" 4K*
Field of view (H)	30° - 7.1°	37° - 8.6°	36° - 8.5°	39° - 10°
Field of view (V)	22° - 5.3°	20° - 4.8°	27° - 6.3°	19° - 5.0°
Field of view (D)	38° - 8.8°	42° - 9.9°	46° - 10.6°	44° - 11°

*4K format 4000x2000 pixels



Visit Theia's website for more information about the TL936 telephoto lenses.

Motor specifications

Focus/ zoom motors

Drive	Stepper motor 2 phase bipolar drive
Operation voltage	3.3V (operating range 2.6~4.8V)
Maximum motor temperature*	Do not let the motor temperature exceed 92°C
Coil resistance	28.5Ω ±7%
Gear ratio	1:2308
Zoom number of steps	2994 steps between hard stops
Zoom speed range	600pps to 1000pps**
Zoom cam rotation	57°
Focus number of steps	5180 steps between hard stops
Focus speed range	600pps to 1000pps**
Focus cam rotation	101°

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).

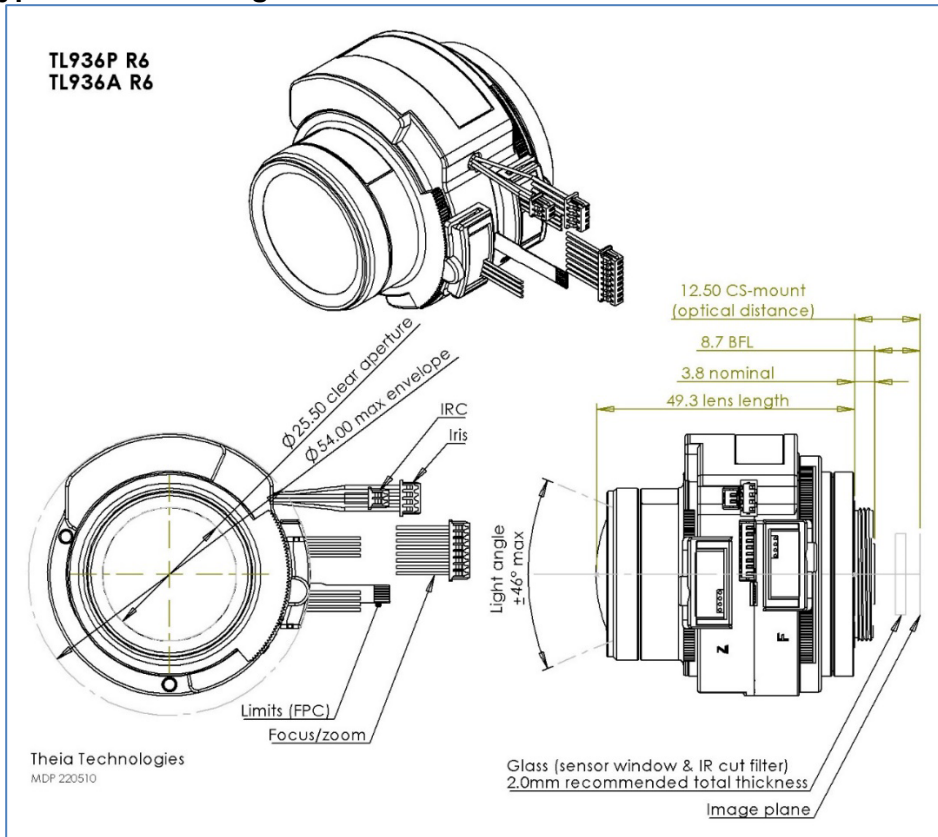
There are some models that include filters for 940nm (long pass >880nm) with either visible or clear glass alternate filter.

Limit switches (on some models)

Type	Photo interrupter Phototransistor (open emitter)
Part model	Sharp GP1S396HCPFSF
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.

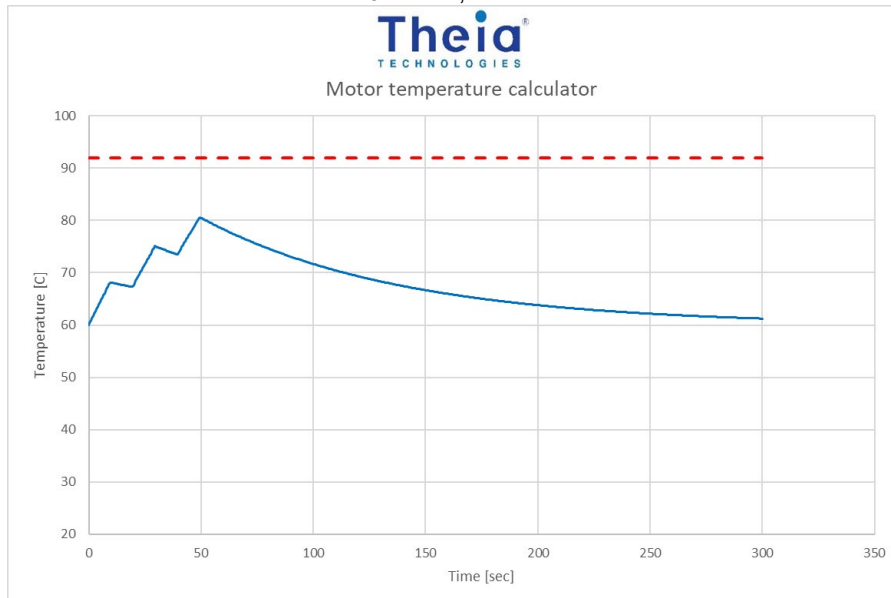
Typical lens drawing



CAD models can be downloaded from
TheiaTech.com/936CAD

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.

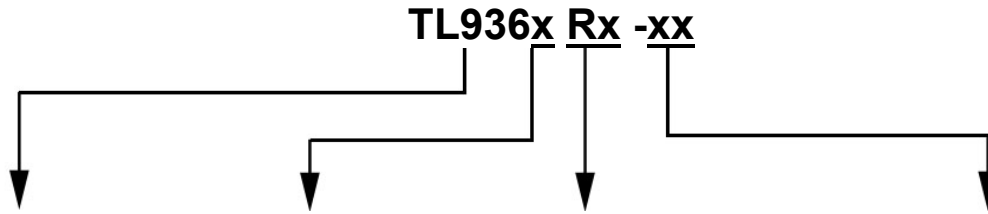


Motor temperature calculator
TheiaTech.com/calculators

****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 <20 steps per full zoom range and <20 steps per full focus range.

Lens model numbers

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 to learn more about our other lens options.



Lens	Iris type	Motor configuration	Mount type
TL936	A: DC autoiris P: P-iris	R3 R4 R5 R6	(blank): CS mount CS: CS mount D25: Ø25mm board mount

Theia® PN	Varifocal	Mount type	Mount slip ring	Iris type	CCTV iris connector	Molex iris connector	IR corrected (day/night)	IR cut switch	Zoom motor	Focus motor	PI limits	Focal length	MP rating	FOV (HxV)	f/#	Image circle	Biggest sensor format	MOD [m]	Lens Length (mount)	Lens Length (TTL)	Weight
TL936A R6 CS	✓	CS	✓	A		✓	✓	✓	✓	✓	✓	9-36	12 (4K)	39x19 to 10.0x5.0	f/1.5	8.3	1/2.3"	2.5	49	61.5	70
TL936A R5 CS	✓	CS	✓	A	✓	✓	✓	✓	✓	✓	72										
TL936A R4 CS	✓	CS	✓	A	✓	✓	✓	✓	✓	✓	69										
TL936P R6 CS	✓	CS	✓	P	✓	✓	✓	✓	✓	✓	68										
TL936P R6 25	✓	D25		P	✓	✓	✓	✓	✓	✓	72										
TL936P R5 CS	✓	CS	✓	P	✓	✓	✓	✓	✓	✓	69										
TL936P R4 CS	✓	CS	✓	P	✓	✓	✓	✓	✓	✓	68										
TL936P R3 CS	✓	CS	✓	P	✓	✓	✓	✓	✓	✓	70										

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Revisions

Version	Change	Reason
160104	Changed DC iris damper coil resistance	Corrected error
	Changed IR cut pin-out	Changed to match industry standard
	Updated production version list	Added new models
160113	Added motor energizing time maximums	Clarification to prevent focus/zoom motor overheating
	Updated temperature spec	Consistent with motor supplier specification
161107	Changed drawing	Added 2mm glass to drawing
170109	Changed PI FPC pin-out	To match bottom side contacts connector; top side connector may have been discontinued
170906	Added pictures and drawings of different lens versions	
180117	Corrected FPC pinout	Pinout numbering was reversed
181206	Motor speed	Updated focus/zoom motor speeds, recommended speeds were not specified. Updated P-iris speed
	Added QR code	Linked to TL936 webpage
200106	Added page number and revision in footer	Revision control

200306	Added Z/F motor step note	Motor position accuracy not previously specified
	Updated motor speed specs	Focus/zoom recommended speed too high, adjusted to tested range
	Zoom/focus map	Changed the map to be more clear and corrected zoom step errors in the table
200327	Added motor cooling graph	New information
	Highlighted model numbers	Clarified which specification sections are applicable to different family members
220516	Templated specification	Allows easier creation of individual lens specifications