

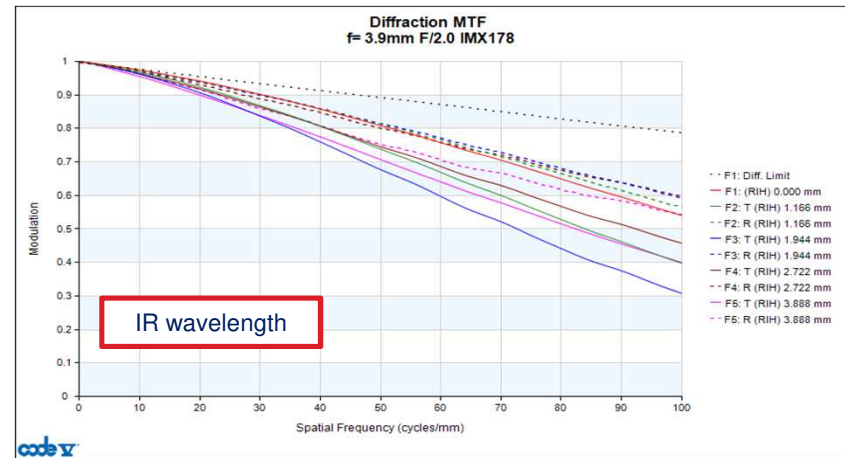
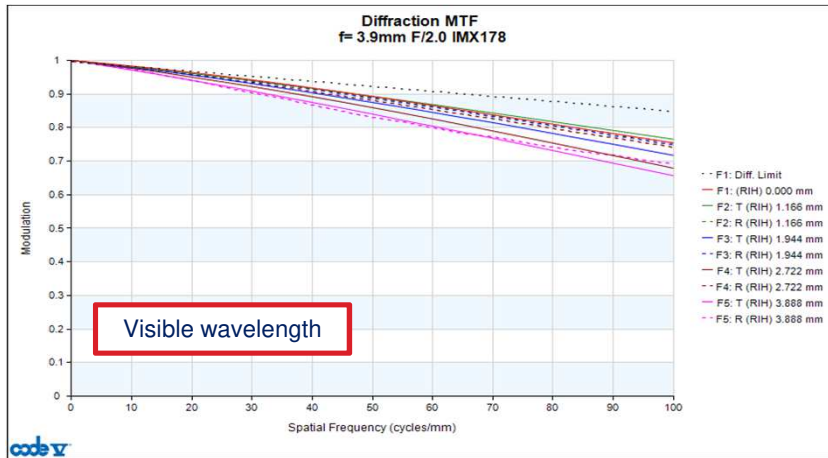


Optical Specification

| | Description | 3.9mm | 5.0mm | 7.6mm | Comment |
|------------------------------|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|
| Basic system parameters | Focal Length (EFL) | 3.9mm ± 0.1mm | 5.0mm ± 0.1mm | 7.6mm ± 0.1mm | Effective Focal Length |
| | Back Focal Length (BFL) | 6.1mm ± 5% | 6.2mm ± 5% | 6.1mm ± 5% | Distance from the rear lens |
| | Flange Back Length(FBL) | 6.0mm ± 0.3mm | 6.1mm ± 0.3mm | 5.7mm ± 0.3mm | Distance from the rear barrel |
| | Full field Of View (FOV) | 127.2° | 99.4° | 60.8° | Diagonal FOV |
| | | 96.1° | 75.5° | 47.9° | Horizontal FOV |
| | | 70.0° | 55.1° | 35.6° | Vertical FOV |
| | F-number (F/#) | 2.0 | 2.0 | 2.0 | ± 5% (at, Infinite) |
| | Sensor model No. | IMX178LQJ (5M 4:3) | IMX178LQJ (5M 4:3) | IMX178LQJ (5M 4:3) | SONY |
| | Sensor model size | 7.78mm(D) x 6.22mm(H) x 4.67mm(V) | 7.78mm(D) x 6.22mm(H) x 4.67mm(V) | 7.78mm(D) x 6.22mm(H) x 4.67mm(V) | Sensing area 1/2-inch CMOS |
| | Wavelengths | 486.1nm~656.3nm / 780nm, 850nm | 486.1nm~656.3nm / 780nm, 850nm | 486.1nm~656.3nm / 780nm, 850nm | Visible & IR Wavelengths |
| | M12 Total Track Length (TTL) | 30.0mm | 30.0mm | 30.5mm | From front surface to image plane |
| M12 Over All Length (OAL) | 24.1mm | 24.1mm | 24.8mm | Lens Assembly Length | |
| Barrel Thread / Mount Format | M12 X P0.5 & CS-Mount | M12 X P0.5 & CS-Mount | M12 X P0.5 & CS-Mount | M12 & CS-Mount | |
| Lens system | Lens Number of Elements | 8 components 8 elements | 8 components 8 elements | 7 components 7 elements | All Glass |
| | Coating MgF2 | Element 1~8 (SLAR Coating) | Element 1~8 (SLAR Coating) | Element 1~7 (SLAR Coating) | SLR Coated Spec : Reflectivity <1% (400nm~700nm) |
| | Image Circle Error | >=8.0mm | >=8.0mm | >=8.0mm | Image Circle Diameter |
| | M12 Out diameter (OD) | Ø17.0 | Ø17.0 | Ø17.0 | M12 Retainer OD |
| Optical performance | Relative Illumination | 48.6% | 63.0% | 44.5% | At full field angle |
| | MTF as a function of line pairs/mm | MTF≥0.755 at 100 (LP/mm) | MTF≥0.733 at 100 (LP/mm) | MTF≥0.732 at 100 (LP/mm) | At center field |
| | | MTF(T)≥0.657 at 100 (LP/mm) | MTF(T)≥0.640 at 100 (LP/mm) | MTF(T)≥0.607 at 100 (LP/mm) | At full field |
| | | MTF(S)≥0.694 at 100 (LP/mm) | MTF(S)≥0.677 at 100 (LP/mm) | MTF(S)≥0.636 at 100 (LP/mm) | At full field |
| Optical Distortion | < -51.0% | < -34.0% | < -12.7% | At, full Field | |



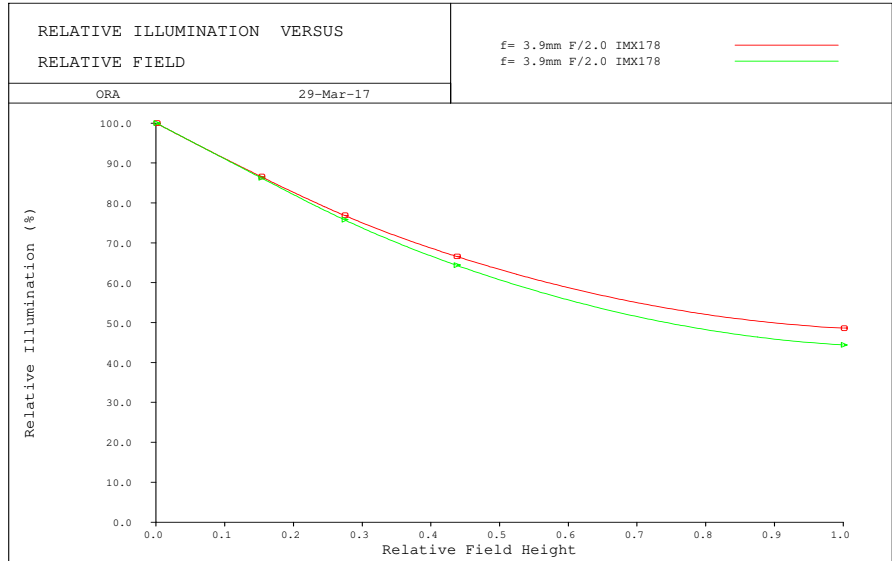
3.9mm MTF (Visible / IR)



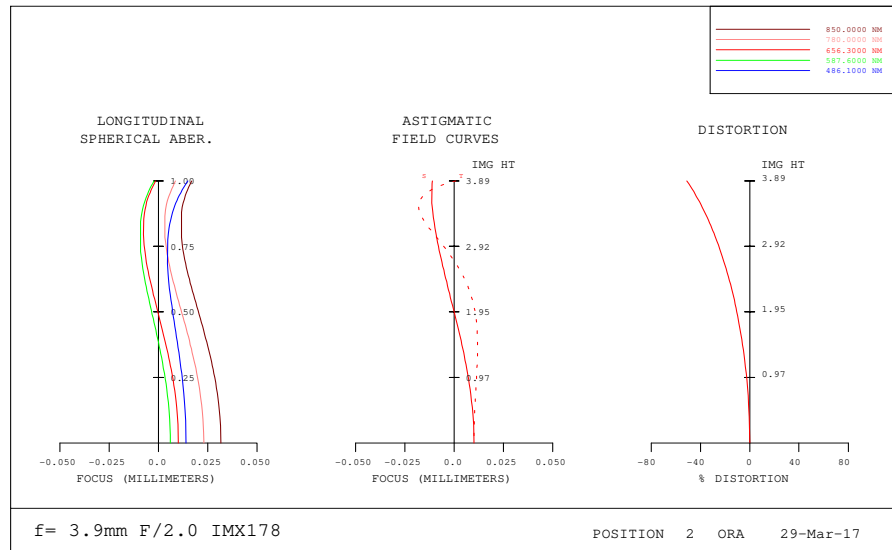
| Description | Visible Wavelength (486.1nm~656.3nm) | IR Wavelength (780nm, 850nm) | Comment |
|------------------------------------|---|------------------------------------|-----------------|
| MTF as a function of line pairs/mm | MTF \geq 0.755 at 100 (LP/mm) | MTF \geq 0.541 at 100 (LP/mm) | At center field |
| | MTF(T) \geq 0.657 at 100 (LP/mm) | MTF(T) \geq 0.401 at 100 (LP/mm) | At full field |
| | MTF(S) \geq 0.694 at 100 (LP/mm) | MTF(S) \geq 0.546 at 100 (LP/mm) | At full field |

• 3.9mm Optical Performance

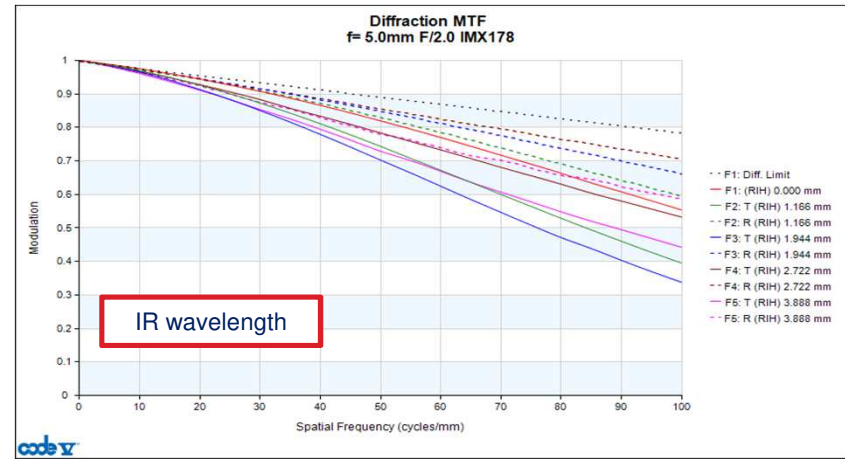
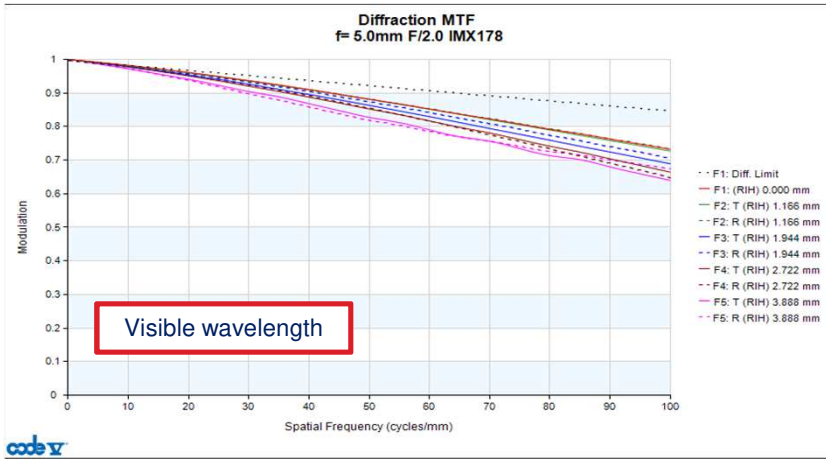
Relative Illumination



Field Curvature & Optical Distortion



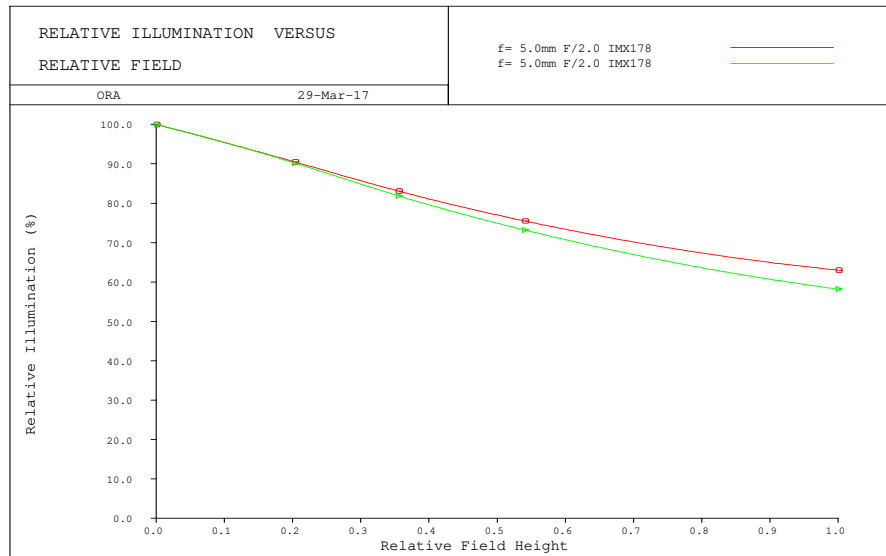
• 5.0mm MTF (Visible / IR)



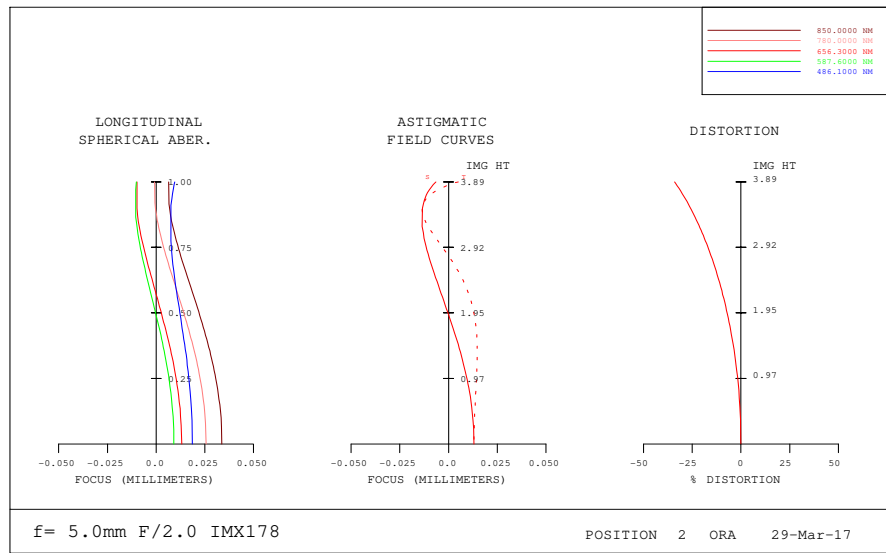
| Description | Visible Wavelength (486.1nm~656.3nm) | IR Wavelength (780nm, 850nm) | Comment |
|------------------------------------|---|------------------------------------|-----------------|
| MTF as a function of line pairs/mm | MTF \geq 0.733 at 100 (LP/mm) | MTF \geq 0.554 at 100 (LP/mm) | At center field |
| | MTF(T) \geq 0.640 at 100 (LP/mm) | MTF(T) \geq 0.442 at 100 (LP/mm) | At full field |
| | MTF(S) \geq 0.677 at 100 (LP/mm) | MTF(S) \geq 0.589 at 100 (LP/mm) | At full field |

• 5.0mm Optical Performance

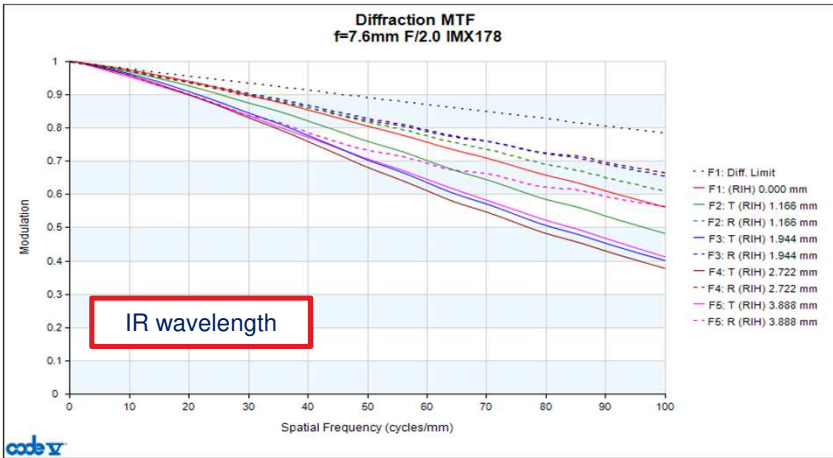
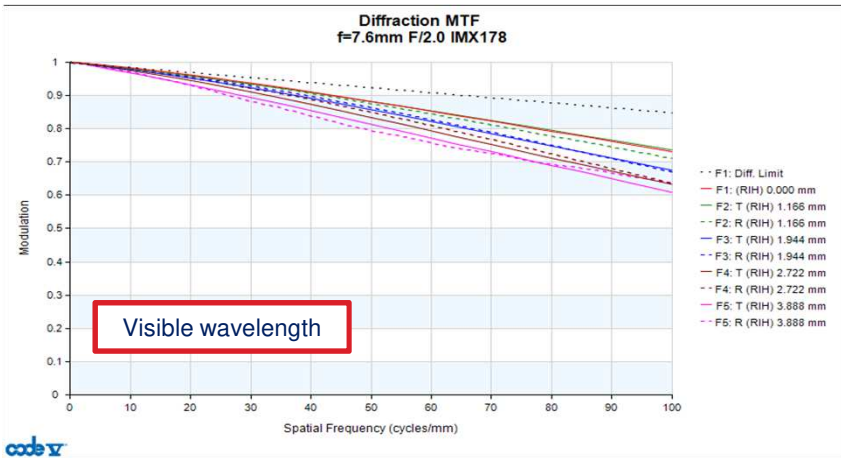
Relative Illumination



Field Curvature & Optical Distortion



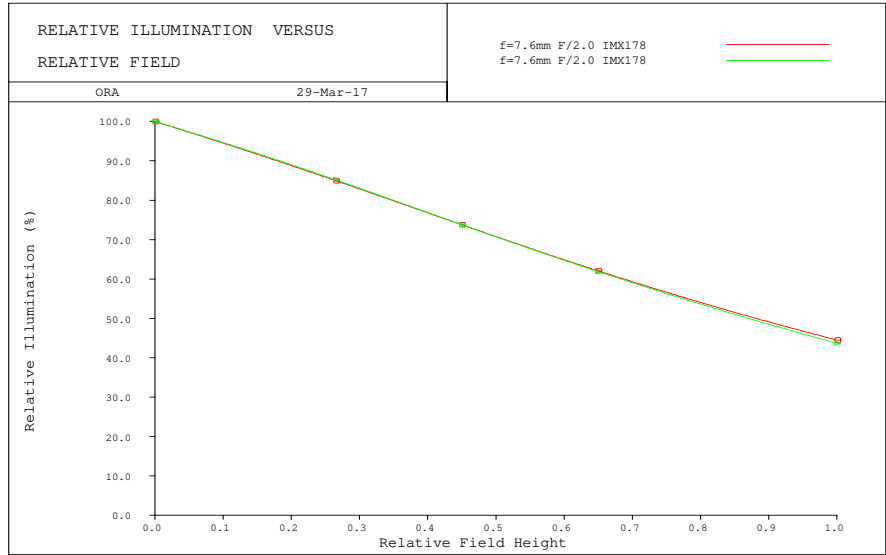
• 7.6mm MTF (Visible / IR)



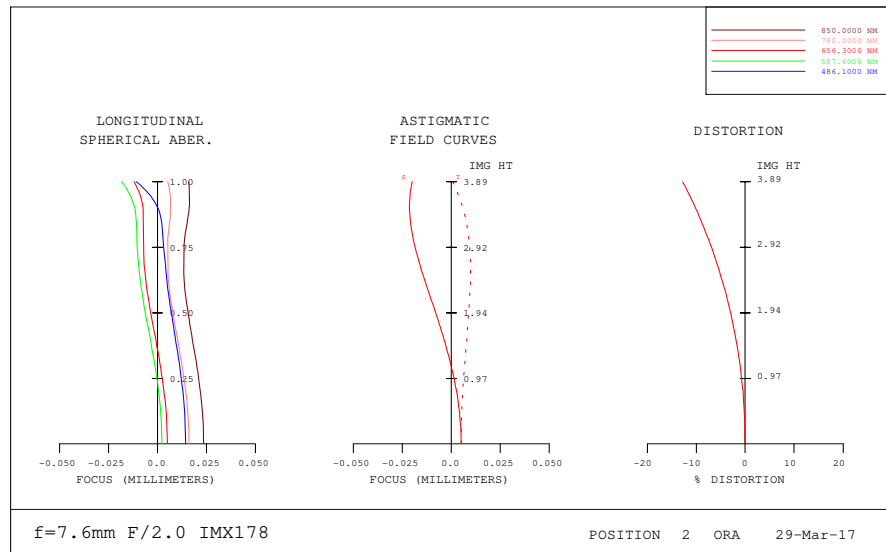
| Description | Visible Wavelength (486.1nm~656.3nm) | IR Wavelength (780nm, 850nm) | Comment |
|------------------------------------|---|------------------------------------|-----------------|
| MTF as a function of line pairs/mm | MTF \geq 0.732 at 100 (LP/mm) | MTF \geq 0.563 at 100 (LP/mm) | At center field |
| | MTF(T) \geq 0.607 at 100 (LP/mm) | MTF(T) \geq 0.412 at 100 (LP/mm) | At full field |
| | MTF(S) \geq 0.636 at 100 (LP/mm) | MTF(S) \geq 0.563 at 100 (LP/mm) | At full field |

• 7.6mm Optical Performance

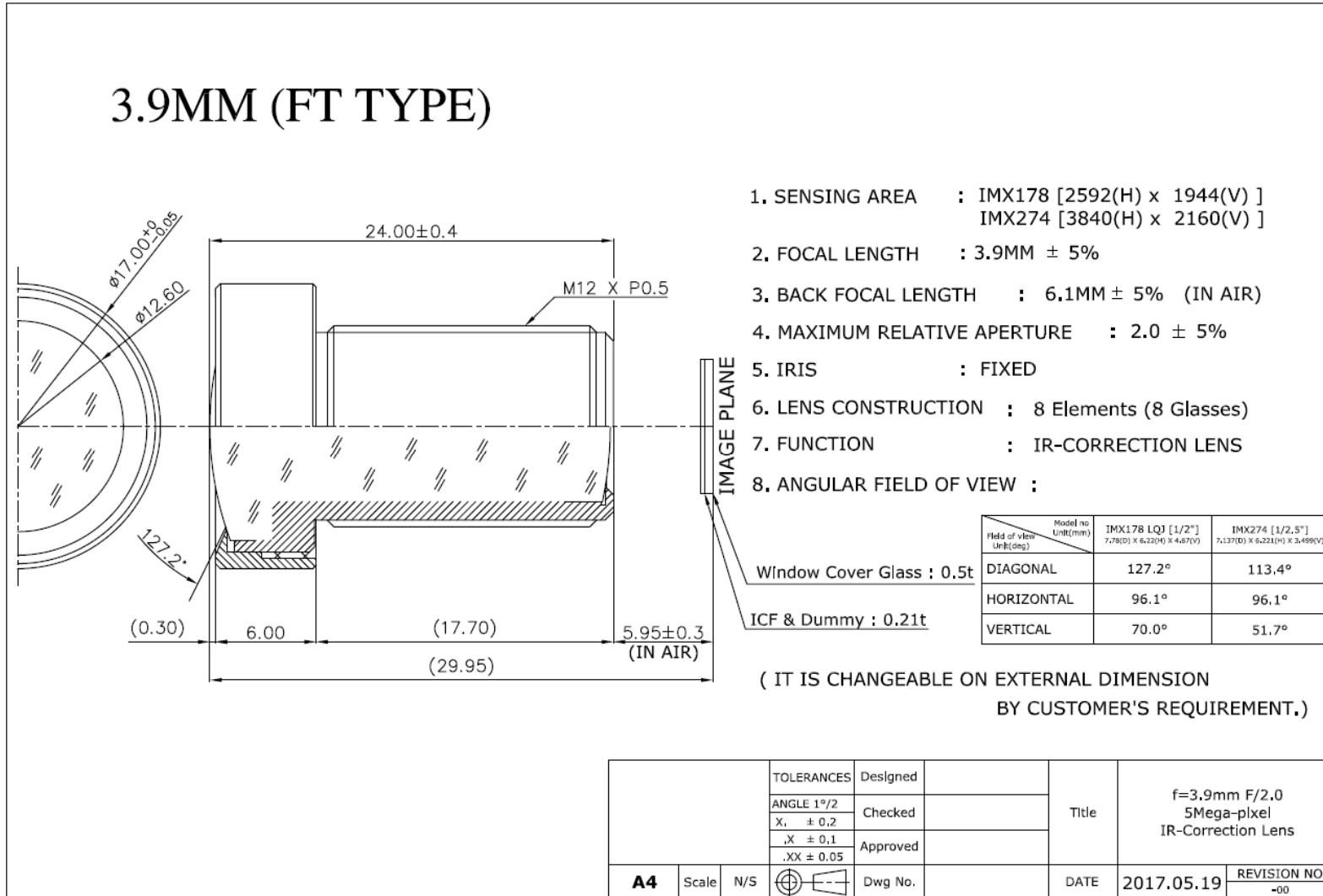
Relative Illumination



Field Curvature & Optical Distortion

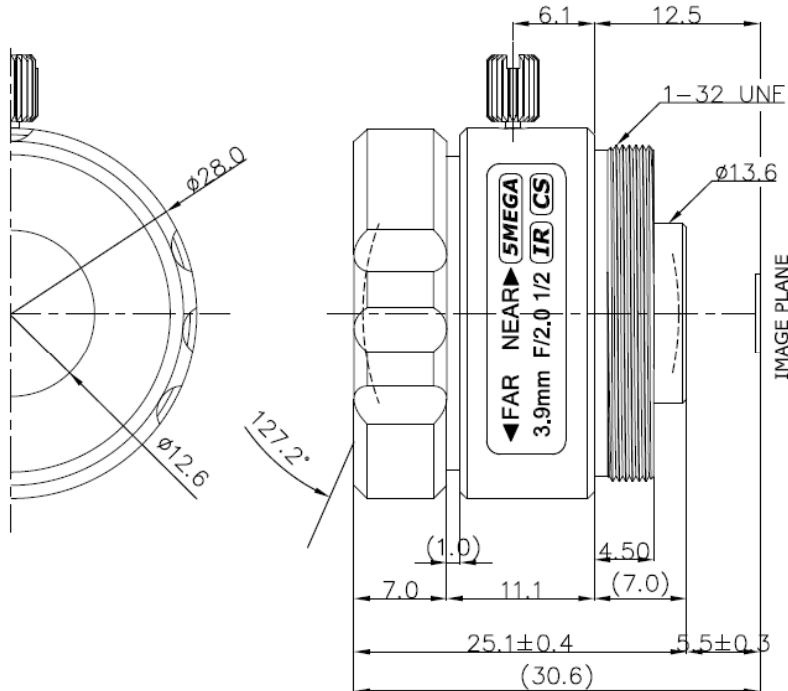


V-553.9-5MP-VIS-IR M12 Optical system 2D Lay out (f=3.9mm)



- V-553.9-5MP-VIS-IR 1/2 Optical system 2D Lay out (f=3.9mm)


3.9MM (CS-MOUNT)



1. SENSING AREA : IMX178 [2592(H) x 1944(V)]
IMX274 [3840(H) x 2160(V)]
2. FOCAL LENGTH : 3.9MM ± 5%
3. BACK FOCAL LENGTH : 6.1MM ± 5% (IN AIR)
4. MAXIMUM RELATIVE APERTURE : 2.0 ± 5%
5. IRIS : FIXED
6. LENS CONSTRUCTION : 8 Elements (8 Glasses)
7. FUNCTION : IR-CORRECTION LENS
8. ANGULAR FIELD OF VIEW :

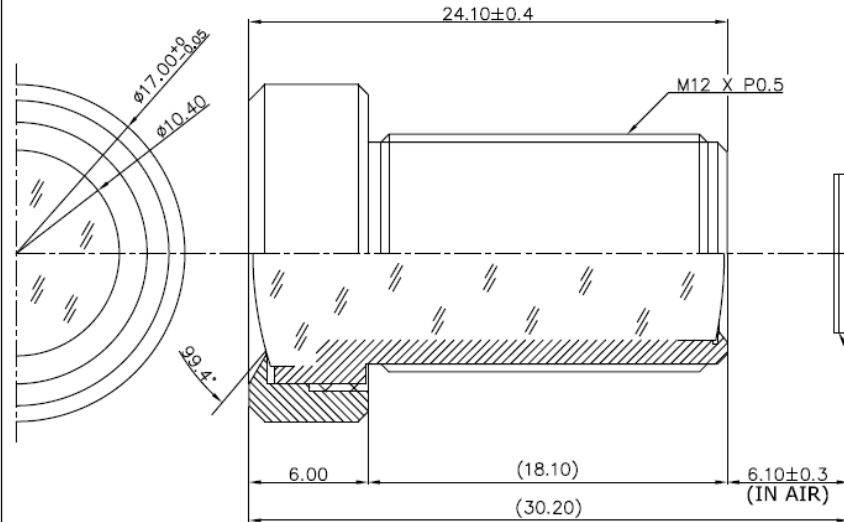
| Field of view Unit(deg) | Model no Unit(mm) | IMX178 LQ] [1/2"] 7.78(H) X 6.22(V) X 4.67(V) | IMX274 [1/2.5"] 7.13(H) X 6.22(H) X 3.49(V) |
|----------------------------|----------------------|--|--|
| DIAGONAL | | 127.2° | 113.4° |
| HORIZONTAL | | 96.1° | 96.1° |
| VERTICAL | | 70.0° | 51.7° |

(IT IS CHANGEABLE ON EXTERNAL DIMENSION
BY CUSTOMER'S REQUIREMENT.)

| | | | | | | | |
|-----------|------------------------|----------|---|---------|---|------------|---------------------|
| | TOLERANCES | Designed | | Title | f=3.9mm F/2.0 5Mega-pxel IR-Correction Lens | | |
| | ANGLE 1°/2 | Checked | | | | | |
| | X, ± 0.2 | Approved | | | | | |
| | .X ± 0.1 .XX ± 0.05 | | | | | | |
| A4 | Scale | N/S |  | Dwg No. | DATE | 2017.05.19 | REVISION NO. -00 |

V-555.0-5MP-VIS-IR M12 Optical system 2D Lay out (f=5.0mm)

5.0MM (FT TYPE)



1. SENSING AREA : IMX178 [2592(H) x 1944(V)]
IMX274 [3840(H) x 2160(V)]
2. FOCAL LENGTH : 5.0MM ± 5%
3. BACK FOCAL LENGTH : 6.2MM ± 5% (IN AIR)
5. IRIS : FIXED
4. MAXIMUM RELATIVE APERTURE : 2.0 ± 5%
6. LENS CONSTRUCTION : 8 Elements (8 Glasses)
7. FUNCTION : IR-CORRECTION LENS
8. ANGULAR FIELD OF VIEW :

Window Cover Glass : 0,5t
ICF & Dummy : 0.21t

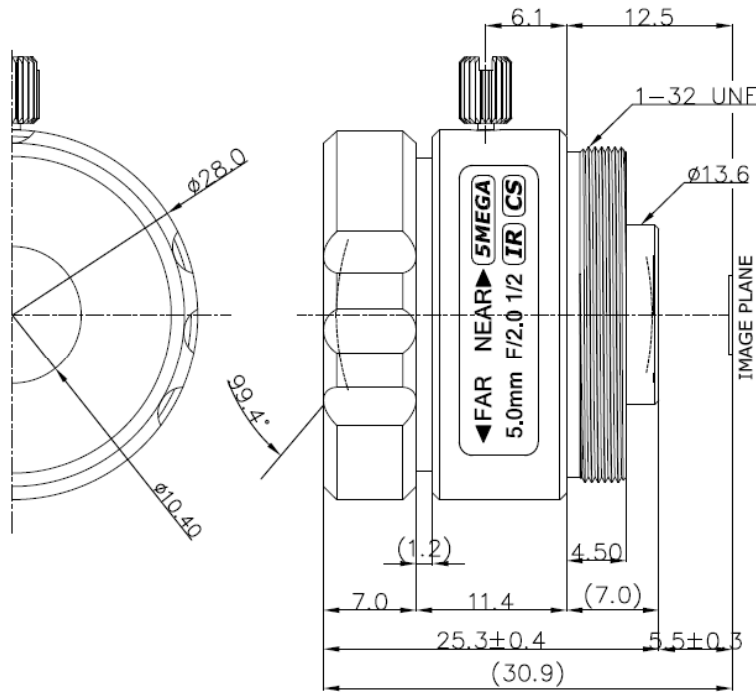
| Field of view Unit(deg) | Model no Unit(mm) | IMX178 LQ1 [1/2"] 7.78(D) X 6.22(H) X 4.67(V) | IMX274 [1/2.5"] 7.137(D) X 6.221(H) X 3.498(V) |
|-------------------------|-------------------|--|---|
| DIAGONAL | | 99.4° | 88.9° |
| HORIZONTAL | | 75.5° | 75.5° |
| VERTICAL | | 55.0° | 40.7° |

(IT IS CHANGEABLE ON EXTERNAL DIMENSION
BY CUSTOMER'S REQUIREMENT.)

| | | | | | | | | |
|-----------|-------|-----|------------------------|----------|--|-------|--|-----|
| | | | TOLERANCES | Designed | | Title | f=5.0mm F/2.0 5Mega-pixel IR-Correction Lens | |
| | | | ANGLE 1°/2 | Checked | | | | |
| | | | X. ± 0,2 | Approved | | | | |
| | | | .X ± 0,1 .XX ± 0,05 | | | | | |
| A4 | Scale | N/S | | Dwg No. | | DATE | 2017.05.19 | |
| | | | | | | | REVISION NO. | -00 |

- V-555.0-5MP-VIS-IR 1/2 Optical system 2D Lay out (f=5.0mm)

5.0MM (CS-MOUNT)



1. SENSING AREA : IMX178 [2592(H) x 1944(V)]
IMX274 [3840(H) x 2160(V)]
2. FOCAL LENGTH : 5.0MM ± 5%
3. BACK FOCAL LENGTH : 6.2MM ± 5% (IN AIR)
4. MAXIMUM RELATIVE APERTURE : 2.0 ± 5%
5. IRIS : FIXED
6. LENS CONSTRUCTION : 8 Elements (8 Glasses)
7. FUNCTION : IR-CORRECTION LENS
8. ANGULAR FIELD OF VIEW :

| Field of view Unit(deg) | Model no Unit(mm) | IMX178 LQ [1/2"] 7.78(H) X 6.22(V) X 4.67(V) | IMX274 [1/2.5"] 7.137(H) X 6.221(H) X 3.499(V) |
|----------------------------|----------------------|---|---|
| DIAGONAL | | 99.4° | 88.9° |
| HORIZONTAL | | 75.5° | 75.5° |
| VERTICAL | | 55.1° | 40.7° |

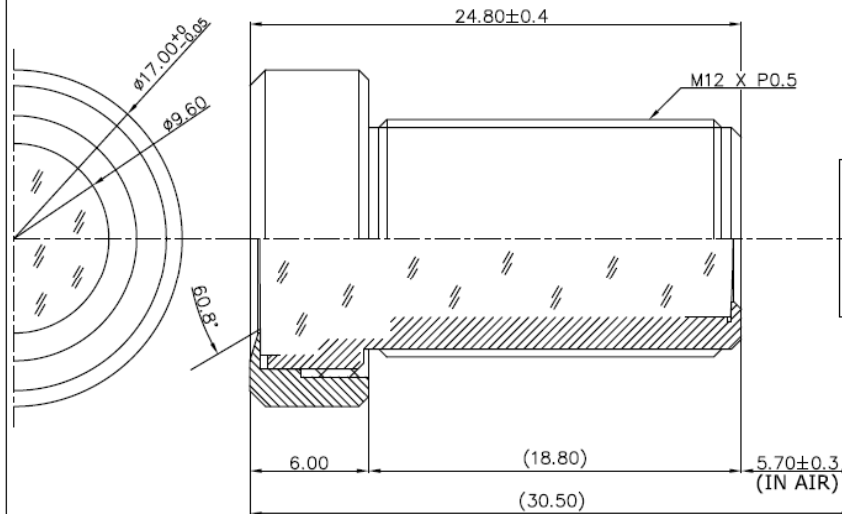
(IT IS CHANGEABLE ON EXTERNAL DIMENSION
BY CUSTOMER'S REQUIREMENT.)

| | | | TOLERANCES | Designed | | | Title | f=5,0mm F/2.0 5Mega-pxel IR-Correction Lens |
|-----------|-------|-----|------------------------|----------|------|------------|--------------|---|
| | | | ANGLE 1°/2 | Checked | | | | |
| | | | X, ± 0.2 | Approved | | | | |
| | | | .X ± 0.1 .XX ± 0.05 | | | | | |
| A4 | Scale | N/S | | Dwg No. | DATE | 2017.06.29 | REVISION NO. | -00 |



- V-557.6-5MP-VIS-IR M12 Optical system 2D Lay out (f=7.6mm)

7.6MM (FT TYPE)



1. SENSING AREA : IMX178 [2592(H) x 1944(V)]
IMX274 [3840(H) x 2160(V)]
2. FOCAL LENGTH : 7.6MM ± 5%
3. BACK FOCAL LENGTH : 6.1MM ± 5% (IN AIR)
4. MAXIMUM RELATIVE APERTURE : 2.0 ± 5%
5. IRIS : FIXED
6. LENS CONSTRUCTION : 7 Elements (7 Glasses)
7. FUNCTION : IR-CORRECTION LENS
8. ANGULAR FIELD OF VIEW :

Window Cover Glass : 0,5t
ICF & Dummy : 0,21t

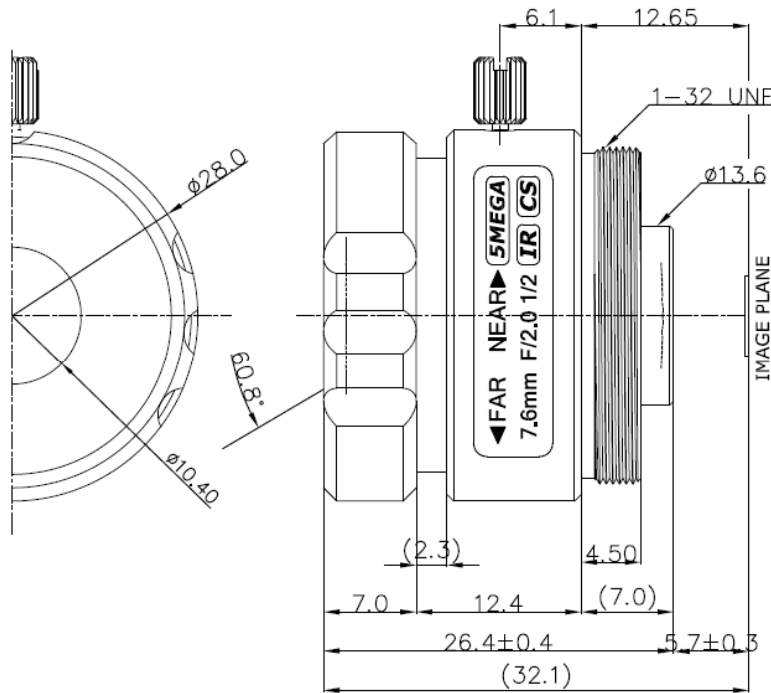
| Field of view Unit(deg) | Model no Unit(mm) | IMX178 LQJ [1/2"] 7,79(H) x 6,22(V) x 4,67(V) | IMX274 [1/2.5"] 7,137(H) x 6,221(H) x 3,499(V) |
|----------------------------|----------------------|--|---|
| DIAGONAL | | 60.8° | 55.4° |
| HORIZONTAL | | 47.9° | 47.9° |
| VERTICAL | | 35.6° | 26.6° |

(IT IS CHANGEABLE ON EXTERNAL DIMENSION
BY CUSTOMER'S REQUIREMENT.)

| TOLERANCES | | | Designed | | Title | f=7,6mm F/2,0 5Mega-pixel IR-Correction Lens |
|------------------------|-------|-----|----------|------|------------|--|
| ANGLE 1°/2 | | | Checked | | | |
| X _c ± 0,2 | | | Approved | | | |
| .X ± 0,1 .XX ± 0,05 | | | | | | |
| A4 | Scale | N/S | Dwg No. | DATE | 2017.05.19 | REVISION NO. -00 |

- V-557.6-5MP-VIS-IR 1/2 Optical system 2D Lay out (f=7.6mm)

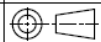
7.6MM (CS-MOUNT)



- SENSING AREA : IMX178 [2592(H) x 1944(V)]
IMX274 [3840(H) x 2160(V)]
- FOCAL LENGTH : 7.6MM ± 5%
- BACK FOCAL LENGTH : 6.1MM ± 5% (IN AIR)
- MAXIMUM RELATIVE APERTURE : 2.0 ± 5%
- IRIS : FIXED
- LENS CONSTRUCTION : 7 Elements (7 Glasses)
- FUNCTION : IR-CORRECTION LENS
- ANGULAR FIELD OF VIEW :

| Field of view Unit(deg) | Model no Unit(mm) | IMX178 LQ [1/2"] 7.78(D) X 6.22(H) X 4.67(V) | IMX274 [1/2.5"] 7.137(D) X 6.221(H) X 3.499(V) |
|----------------------------|----------------------|---|---|
| DIAGONAL | | 60.8° | 55.4° |
| HORIZONTAL | | 47.9° | 47.9° |
| VERTICAL | | 35.6° | 26.6° |

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BY CUSTOMER'S REQUIREMENT.)

| | | | | | | | | |
|-----------|-------|-----|---|----------|--|-------|--|---------------------|
| | | | TOLERANCES | Designed | | Title | f=7.6mm F/2.0 5Mega-pixel IR-Correction Lens | |
| | | | ANGLE 1°/2 | Checked | | | | |
| | | | .X ± 0.2 | Approved | | | | |
| | | | .XX ± 0.05 | | | | | |
| A4 | Scale | N/S |  | Dwg No. | | DATE | 2017.06.29 | REVISION NO. -00 |