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QHYCCD

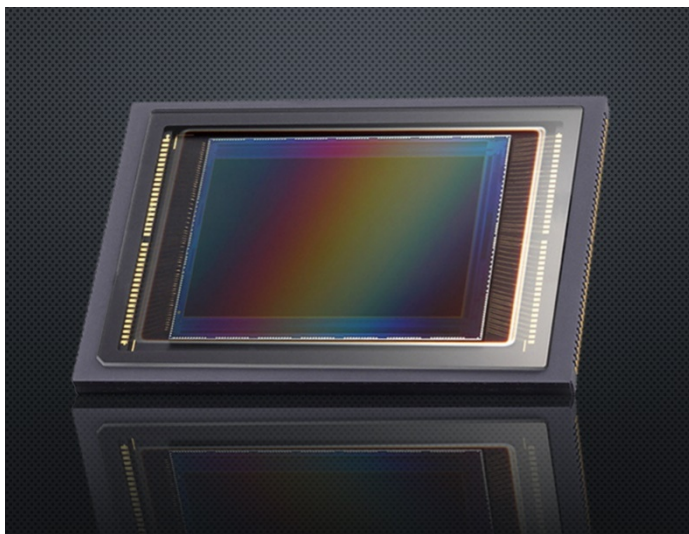


QHY411 **151 Megapixel** **Scientific CMOS**



QHY411

151 Megapixels
Back-Illuminated
16-bit A/D
1e- Read Noise
Mono or Color



Features:

- **World's Highest Resolution sCMOS**
- **151 Megapixels, 3.76um**
- **67.2mm Diagonal**
- **Native 16-bit A/D**
- **Ultra-Low 1e- Read Noise**
- **Deep Full Well, High Dynamic Range**
- **Back-Illuminated High QE Sensor**
- **Low Dark Current**
- **USB 3.0 and 10GigaE**
- **Air and Water Cooling**

World's Largest Resolution, 151 Megapixels

The QHY411 is the highest resolution cooled scientific CMOS camera in the world. The 151 Megapixel SONY IMX411 back-illuminated sensor has a 14192 x 10640 pixel array with 3.76um pixels. The sensor size is 54mm x 40mm. The QHY411 is available in both monochrome and color versions.

Native 16-bit A/D, 65536 levels

The QHY411 is also the world's first scientific CMOS camera with native 16-bit A/D on-chip. The output is real 16-bits with 65536 levels. Most CMOS sensors are 12-bit or 14-bit. This means that the conversion ratio cannot achieve 1e-/ADU and weak signals are not very highly sampled. Photometric measurements of low signals in such case are not as accurate. Some cameras combine two 12-bit outputs to create 16-bit images, but the actual number of levels is still $4096 \times 2 = 8192$ levels, significantly less than native 16-bits.



Ultra-Low Read Noise, 1 Electron at High Gain, 2.4e- to 2.8e- at Low Gain

The QHY411 has only one electron of read noise at high gain and 1FPS (16-bit), 2FPS (8-bit) high readout speed. One electron of read noise means the camera can achieve a $SNR > 3$ at only 3 to 4 photons. This is perfect performance when conditions are photon limited, i.e., short exposures, narrow band imaging, etc., making this large area sensor ideal for sky surveys and time domain astronomy. At low gain the read noise is still only 2.4e- to 2.8e-.

Full Well Capacity of 44ke- at 3.76um, 396ke- at 11um

One benefit of the back-illuminated CMOS structure is improved full well capacity. This is particularly helpful for sensors with small pixels. The QHY411 has a full well capacity of 44ke- even with unbinned 3.76um pixels. When binned 2x2 to 7.5um the full well is 176ke- and when binned 3x3 to 11um the full well is 396ke-.

Back-Illuminated, Electric Rolling Shutter, Low Dark Current

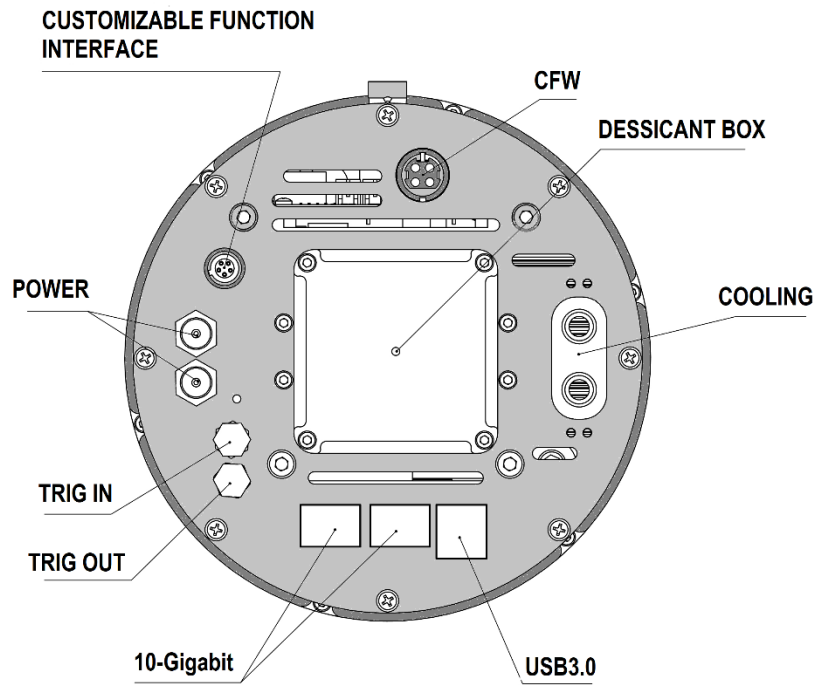
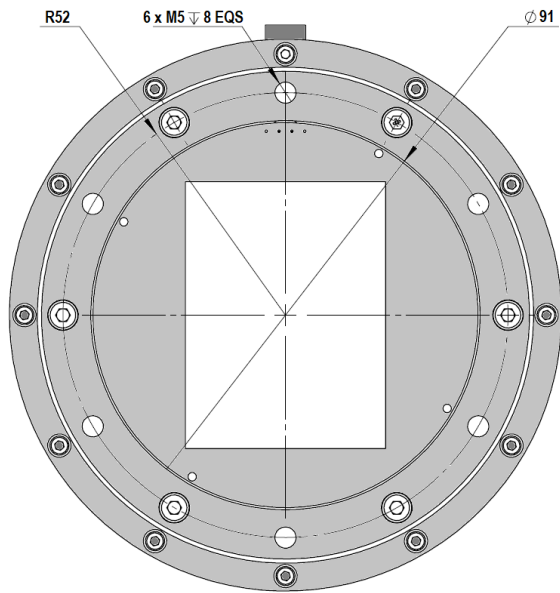
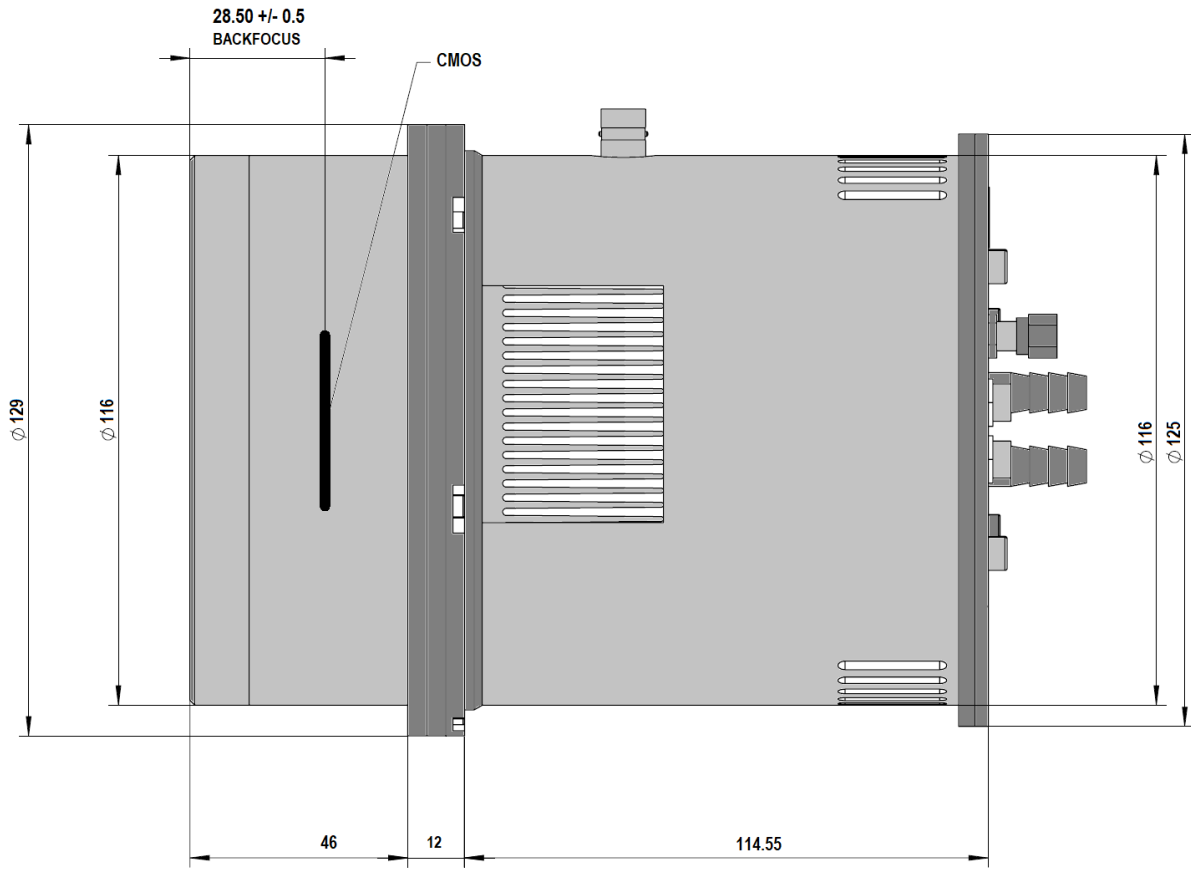
The QHY411 sensor is back-illuminated and has extremely low dark current using SONY's Exmor BSI sCMOS technology. This means the camera is not only ideal for short exposures due to its low read noise, but is also ideal for long exposures where dark current noise often dominates. To further reduce the dark current noise, the QHY411 incorporated QHYCCD's proprietary thermal noise reduction technology and two-stage thermoelectric cooling to reduce the temperature of the sensor.

USB3.0 / 2 x 10Gigabit Fiber

The QHY411 interface is USB3.0 plus 2 x 10Gigabit Fiber port. USB3.0 supports 2 FPS readout speed at 8-bits, 1 FPS at 16-bits and short bursts of 2 FPS at 16-bits. 10Gigabit supports 2.6 FPS at 16-bits continuous.

Air / Liquid Cooling

The QHY411 has 2-stage TE cooling that will cool to -30C below ambient with air (fan) only, or -45C below ambient with water circulation.



PRELIMINARY SPECIFICATIONS

Model	QHY411U3G20
Image Sensor	SONY IMX411 BSI CMOS Sensor
Mono / Color Version	Both Available (QHY411U3G20M / QHY411U3G20C)
Pixel Size	3.76um x 3.76um
Effective Pixels	151 Megapixels
Sensor Diagonal Size	67.2mm
Effective Image Area	54mm x 40mm
Full Well Capacity (1x1, 2x2, 3x3)	44ke- / 176ke- / 396ke-
A/D	16-bit (0-65535 greyscale)
Sensor Optical Format	TYPICAL 4.2inch
Full Frame Rates	USB3.0 2.0 FPS at 8-bits 1.0 FPS at 16-bits 2.6 FPS at 16-bits in burst mode (< 6 frames) 2x10Gigabit Fiber 2.6 FPS at 16-bits
Read Noise	1.0e-at high gain, 2.4e- to 2.8e- at low gain
Dark Current	TBD
Exposure Time Range	20us -3600sec
Shutter Type	Electronic Rolling Shutter
Computer Interface	USB 3.0 and 2x10Gigabit Fiber
Trigger Port	Trigger In / Out, High Speed Sync Port
Built-in Image Buffer	2 GByte (16 Gb)
Internal Image Storage	Total 64MByte Flash Memory. 10MBytes user-accessible for stellar ROI frames for analysis of exoplanet investigation, occultations, atmospheric seeing measurement, focus , optic analysis etc. Support 100x100 image x 500 frames, 50x50 image x 4000 frames, 25x25 image x 16000 frames, 10x10 image x 250000 frames
FPGA Upgrade Via USB	Supported
Cooling System	Dual Stage TEC. -45C from ambient with water, -30C with fan only
Anti-Dew Heater	Yes
Telescope Interface	TBD
Optical Window	AR+AR High Quality Multi-Layer Anti-Reflection Coating
Power Requirements	12VDC, 5A

