MACHINE VISION

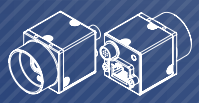
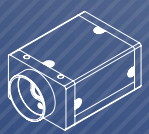
CAMERA CATALOG AND SENSOR REVIEW

10 GIGE VISION | USB3 VISION | GiGE VISION

flir.com/mv

FLIR

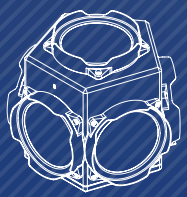
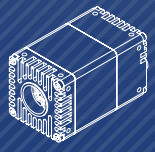


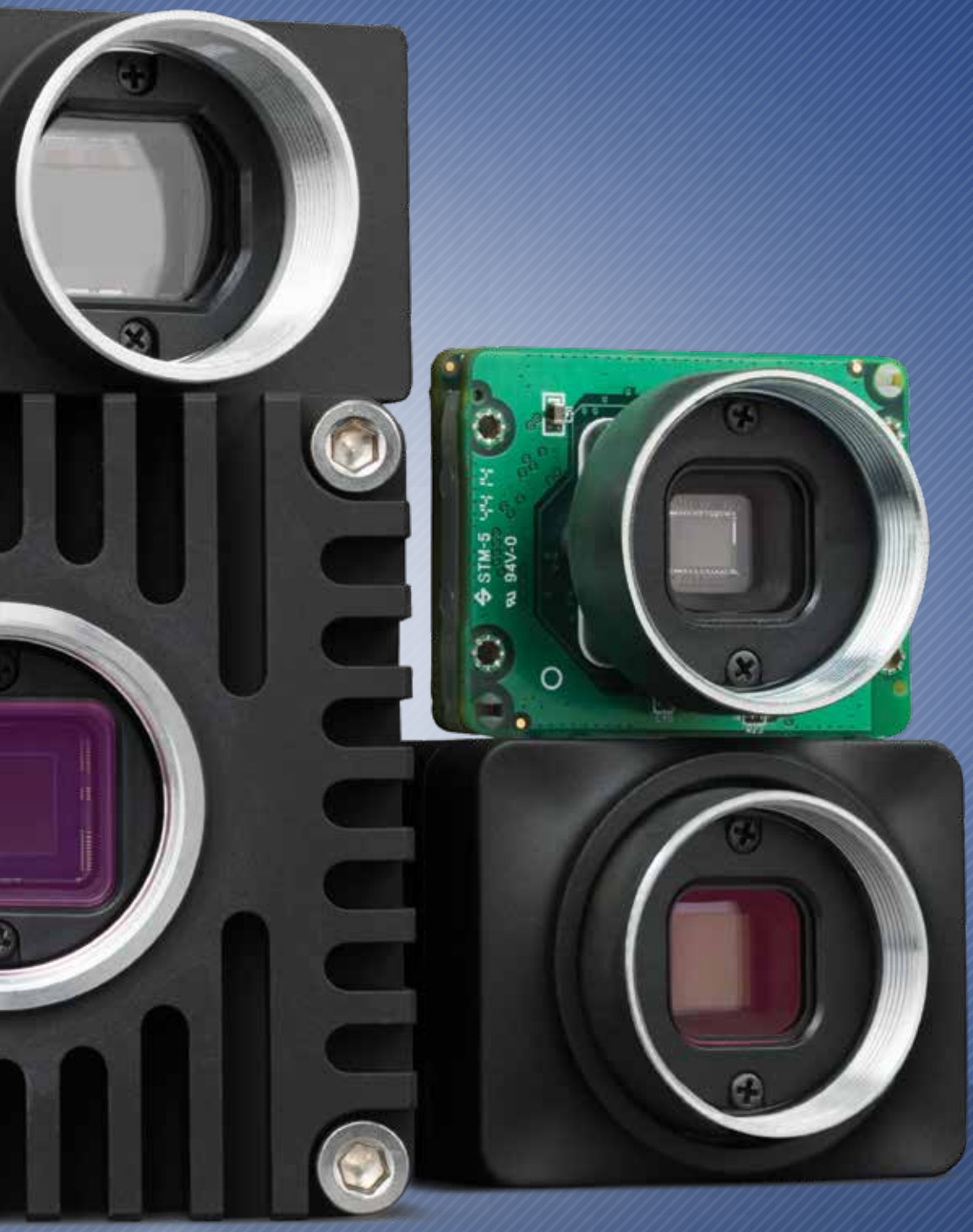




2000	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
First IEEE 1394 stereo vision camera Digiclops	First IEEE 1394 imaging camera Firefly	First spherical vision camera Ladybug	First IEEE 1394b camera Dragonfly Express	New products Dragonfly2 Ladybug2	New products Flea2 Firefly MV	New products Grasshopper FirePRO	New product USB 2.0 camera Chameleon New product Ladybug3	World's first USB 3.0 Camera	New product Flea3 New product GigE camera Grasshopper2	First Camera Link camera Gazelle First USB 3.0 camera Flea3 World's smallest GigE camera Flea3 New product Grasshopper Express	New Product IP camera Zebra2 World's Smallest PoE GigE Camera Blackfly	New USB3 products Ladybug5 Grasshopper3	New USB3 product Blackfly USB 3.0 New GigE product Grasshopper3	New USB3 product Chameleon 3	New USB3 and GigE Vision product Blackfly S	10 GigE Camera Oryx	Board-level Blackfly S

QUICK FACTS

- FLIR acquired Point Grey in Nov 2016
- FLIR IIS Achieves ISO 9001:2015 Certification
- Designed and manufactured in **Canada**
- **3 year warranty** on most products
- **Global offices** & distribution network



High performance imaging solutions

FLIR is a global leader in the design and manufacture of innovative, high-performance digital cameras for industrial, medical and life science, traffic, biometric, GIS, and people counting applications. We offer a unique and comprehensive portfolio of USB 3.1, 10 GigE, GigE, FireWire, and USB 2.0 products known for their outstanding quality, ease of use, and unbeatable price-performance.

USB 3.1 Camera Features:

- Largest selection of CMOS and CCD sensors
- FPGA and frame buffer-based architecture for optimal reliability
- Proprietary USB 3.1 link layer and driver stack
- Industry-standard C- and CS- mount
- Fully tested USB 3.1 Gen 1 accessories: interface cards, hubs, and cables

BLACKFLY® S

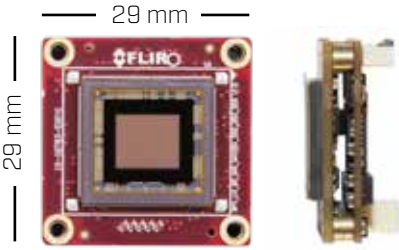
UP TO 20 MP CMOS IN AN ICE CUBE

Model#	Sensor Specifications		Shutter	Max Res	Max FPS
BFS-U3-04S2C/M-CS	0.4MP	Sony IMX287 CMOS* 1/2.9"	6.9µm Global	720 x 540	523 fps
BFS-U3-13Y3C/M-C	1.3MP	ON Semi PYTHON 1300 CMOS 1/2"	4.8µm Global	1280 x 1024	170 fps
BFS-U3-16S2C/M-CS	1.6MP	Sony IMX273 CMOS* 1/2.9"	3.45 µm Global	1440 x 1080	241 fps
BFS-U3-31S4M/C-C	3.2 MP	Sony IMX265 CMOS* 1/1.8"	3.45 µm Global	2048 x 1536	57 fps
BFS-U3-32S4C/M-C	3.2MP	Sony IMX252 CMOS* 1/1.8"	3.45 µm Global	2048 x 1536	118 fps
BFS-U3-51S5M/C-BD2	5.0 MP	Sony IMX250 CMOS* 2/3"	3.45 µm Global	2448 x 2048	75 fps
BFS-U3-50S5M/C-BD2	5.0 MP	Sony IMX264 CMOS* 2/3"	3.45 µm Global	2448 x 2048	35 fps
BFS-U3-50S4M/C-C	5.0 MP	Sony IMX264 CMOS* 2/3"	3.45 µm Global	2448 x 2048	35 fps
BFS-U3-51S5C/M-C	5.0MP	Sony IMX250 CMOS* 2/3"	3.45 µm Global	2448 x 2048	75 fps
BFS-U3-51S5P-C	5.0 MP	Sony IMX250MZR CMOS* 2/3"	3.45 µm Global	2448 x 2048	75 fps
BFS-U3-63S4M/C-C	6.3 MP	Sony IMX178 CMOS** 1/1.8"	2.4 µm Rolling	3072 x 2064	60 fps
BFS-U3-89S6C/M-C	8.9MP	Sony IMX255 CMOS* 1"	3.45 µm Global	4096 x 2160	43 fps
BFS-U3-88S6M/C-C	8.9 MP	Sony IMX267 CMOS* 1"	3.45 µm Global	4096 x 2160	32 fps
BFS-U3-120S4M/C-C	12.0 MP	Sony IMX226 CMOS** 1/1.7"	1.86 µm Rolling	4000 x 3000	31 fps
BFS-U3-122S6M/C-C	12.3 MP	Sony IMX304 CMOS* 1.1"	3.45 µm Global	4096 x 3000	9.9 fps
BFS-U3-123S6C/M-C	12.3 MP	Sony IMX253 CMOS* 1.1"	3.45 µm Global	4096 x 3000	30 fps
BFS-U3-200S6C/M-C	20 MP	Sony IMX183 CMOS** 1"	2.4 µm Rolling	5472 x 3648	18 fps
BFS-U3-23S3M/C-C[1]	2.3 MP	Sony IMX392 CMOS* 1/2.3"	3.45 µm Global	1920 x 1200	164 fps
BFS-U3-70S7M/C-C[1]	7.1 MP	Sony IMX428 CMOS* 1.1"	4.5 µm Global	3208 x 2200	51 fps

[1]Coming Soon *High performance Sony Pregius™ Global Shutter CMOS ***Sony Exmor R™ CMOS

INTERFACE	USB 3.1 Gen 1 interface with screw locks for camera control, data, and power
GPIO	6-pin Hirose HR10A-7R-6PB GPIO connector for trigger, strobe, and power. 1 opto-isolated input, 1 opto-isolated output. 1 bi-directional I/O pin, 1 input pin.
ADC	12-bit • 10-bit (BFS-U3-13Y3)
IMAGE DATA FORMATS	Mono8, Mono16, Bayer8, Bayer16, RGB8, YCbCr8, YCbCr411_8, YCbCr422_8
PARTIAL IMAGE MODES	Pixel binning and region of interest (ROI) modes
GAMMA	0.50 to 4.00, programmable lookup table
TRIGGER MODES	External trigger and software trigger
IMAGE BUFFER	240 MB
USER SETS	2 memory channels for custom camera settings
SIZE (WxHxD)	29 x 29 x 30 mm excluding lens holder (metal case)
MASS	36g (Without optics or tripod mounting bracket)
POWER	8-24 V via GPIO or 5 V via USB 3.1 interface, <3 W
LENS MOUNT	C-mount, CS-mount
TEMPERATURE	-30° to 60°C (storage) • 0° to 50°C (operating)
WARRANTY	3 years

FLIR BLACKFLY® S FOR EMBEDDED SYSTEMS



ACTUAL SIZE

DEVELOP ONCE, DEPLOY EVERYWHERE

New to the FLIR Blackfly S family is a high performance, board level version designed for embedded systems. It boasts a rich feature-set and the latest Sony Pregius CMOS sensors. It is ready for integration with proven compatibility with popular SBCs and operating systems. The Blackfly S board-level models enable you to build smaller, lighter, and lower cost solutions without sacrificing image quality or speed.

KEY FEATURES

- With its 29 x 29 mm board level footprint and low-profile **Flexible Printed Circuit** (FPC) connectors for **USB 3.1 or GigE**, the Blackfly S is ideal for embedding into mobile and handheld devices.
- FLIR Blackfly S cameras feature the latest **CMOS sensors** and advanced on-camera features including binning, **auto-exposure** and **color transformation** tools.
- Proven combability with popular **ARM** and **x64** SBCs, operating systems, and software ensures support for an entire ecosystem of **embedded systems.**

BLACKFLY®

PERFORMANCE AND VALUE

Model#	Sensor Specifications				Shutter	Max Res	Max FPS
BFLY-U3-03S2C/M-CS	0.3MP	Sony ICX424 CCD	1/3″	7.4 µm	Global	648 x 488	84 fps
BFLY-U3-05S2C/M-CS	0.5MP	Sony ICX693 CCD	1/3″	6.0 µm	Global	808 x 608	50 fps
BFLY-U3-13S2C/M-CS	1.3MP	Sony ICX445 CCD**	1/3″	3.75 µm	Global	1288 x 964	30 fps
BFLY-U3-20S4C/M-CS	2.0MP	Sony ICX274 CCD**	1/1.8″	4.4 µm	Global	1624 x 1224	15 fps
BFLY-U3-23S6C/M-C	2.3MP	Sony IMX249 CMOS*	1/1.2″	5.86 µm	Global	1920 x 1200	41 fps
BFLY-U3-50H5C/M-C	5.0MP	Sharp RJ32S4/S3AA0DT	2/3″	3.45 µm	Global	2448 x 2048	7.5 fps

*High performance Sony Pregius™ Global Shutter CMOS **High sensitivity Sony EXview HAD CCD™

CHAMELEON®3

FLEXIBLE FORM FACTOR

Model#	Sensor Specifications				Shutter	Max Res	Max FPS
CM3-U3-13S2C/M-CS	1.3MP	Sony ICX445 CCD**	1/3″	3.75 µm	Global	1288 x 964	30 fps
CM3-U3-13S2C/M-CS-BD	1.3MP	Sony ICX445 CCD**	1/3″	3.75 µm	Global	1288 x 964	30 fps
CM3-U3-13Y3C/M-CS	1.3MP	ON Semi PYTHON 1300 CMOS	1/2″	4.8 µm	Global	1280 x 1024	149 fps
CM3-U3-13Y3C/M-S-BD	1.3MP	ON Semi PYTHON 1300 CMOS	1/2″	4.8 µm	Global	1280 x 1024	149 fps
CM3-U3-28S4C/M-CS	2.8MP	Sony ICX818 CCD**	1/1.8″	3.69 µm	Global	1928 x 1448	13 fps
CM3-U3-31S4C/M-CS	3.2MP	Sony IMX265 CMOS*	1/1.8″	3.45 µm	Global	2048 x 1536	55 fps
CM3-U3-50S5C/M-CS	5.0MP	Sony IMX264 CMOS*	2/3″	3.45 µm	Global	2448 x 2048	35 fps

*High performance Sony Pregius™ Global Shutter CMOS **High sensitivity Sony EXview HAD CCD™

BLACKFLY®	CHAMELEON®3	
USB 3.1 Gen 1 interface with screw locks for camera control, data, and power	USB 3.1 Gen 1 interface with screw locks for camera control, data, and power	INTERFACE
6-pin Hirose HR10A-7R-6PB GPIO connector for trigger, strobe, and power. 1 opto-isolated input, 1 opto-isolated output	9-pin JST GPIO connector, 4 pins for trigger and strobe, 1 pin +3.3 V, 1 VEXT pin for external power 1 opto-isolated input, 1 opto-isolated output	GPIO
12-bit	12-bit • 10-bit (CM3-U3-13Y3)	ADC
Y8, Y16, Mono8, Mono12, Mono16 (all models) RGB8, YUV411, YUV422, YUV444, Raw8, Raw12, Raw16 (color models)	Y8, Y16, Mono8, Mono12, Mono16 (all models) RGB8, YUV411, YUV422, YUV444, Raw8, Raw12, Raw16 (color models)	IMAGE DATA FORMATS
Pixel binning and region of interest (ROI) modes	Pixel binning and region of interest (ROI) modes	PARTIAL IMAGE MODES
0.50 to 4.00, programmable lookup table	0.50 to 4.00, programmable lookup table	GAMMA
Standard, bulb, multi-shot, overlapped, low smear mode (CCD models only)	Standard, bulb, multi-shot, overlapped, low smear mode (CCD models only)	TRIGGER MODES
16 MB frame buffer	16 MB frame buffer	IMAGE BUFFER
2 memory channels for custom camera settings	2 memory channels for custom camera settings	USER SETS
29 x 29 x 30 mm excluding lens holder (metal case)	44 x 35 x 19.5 mm excluding lens holder (metal case)	SIZE (WxHxD)
36g (Without optics or tripod mounting bracket)	55g (Without optics or tripod mounting bracket)	MASS
5-24 V via GPIO or 5 V via USB 3.1 interface, <2.5W	5 - 24 V via GPIO or 5 V via USB 3.1 interface, <3 W	POWER
CS-mount, C-mount	CS-mount	LENS MOUNT
-30° to 60°C (storage) • 0° to 45°C (operating)	-30° to 60°C (storage) • 0° to 45°C (operating)	TEMPERATURE
3 years	3 years	WARRANTY

GRASSHOPPER®3

HIGH PERFORMANCE CMOS AND CCD

Model#	Sensor Specifications		Shutter	Max Res	Max FPS
GS3-U3-14S5C/M-C	1.4MP Sony ICX285 CCD	2/3"	6.45 µm Global	1384 x 1036	30 fps
GS3-U3-15S5C/M-C	1.4MP Sony ICX825 CCD	2/3"	6.45 µm Global	1384 x 1036	45 fps
GS3-U3-23S6C/M-C	2.3MP Sony IMX174 CMOS*	1/1.2"	5.86 µm Global	1920 x 1200	163 fps
GS3-U3-28S4C/M-C	2.8MP Sony ICX687 CCD**	1/1.8"	3.69 µm Global	1928 x 1448	26 fps
GS3-U3-28S5C/M-C	2.8MP Sony ICX674 CCD**	2/3"	4.54 µm Global	1920 x 1440	26 fps
GS3-U3-32S4C/M-C	3.2MP Sony IMX252 CMOS*	1/1.8"	3.45 µm Global	2048 x 1536	121 fps
GS3-U3-41S4C/M-C	4.1MP Sony ICX808 CCD**	1/1.8"	3.1 µm Global	2016 x 2016	18 fps
GS3-U3-41C6NIR-C	4.1MP CMOSIS CMV4000-3E12 CMOS	1"	5.5 µm Global	2048 x 2048	90 fps
GS3-U3-41C6C/M-C	4.1MP CMOSIS CMV4000-3E5 CMOS	1"	5.5 µm Global	2048 x 2048	90 fps
GS3-U3-50S5C/M-C	5.0MP Sony ICX625 CCD	2/3"	3.45 µm Global	2448 x 2048	15 fps
GS3-U3-51S5C/M-C	5.0MP Sony IMX250 CMOS*	2/3"	3.45 µm Global	2448 x 2048	75 fps
GS3-U3-60S6C/M-C	6.0MP Sony ICX694 CCD**	1"	4.54 µm Global	2736 x 2192	13 fps
GS3-U3-60Q6C/M-C	6.0MP Sony ICX694 CCD**	1"	4.54 µm Global	2736 x 2192	25 fps
GS3-U3-89S6C/M-C	8.9MP Sony IMX255 CMOS*	1"	3.45 µm Global	4096 x 2160	43 fps
GS3-U3-91S6C/M-C	9.1MP Sony ICX814 CCD**	1"	3.69 µm Global	3376 x 2704	9 fps
GS3-U3-120S6C/M-C	12MP Sony ICX834 CCD**	1"	3.1 µm Global	4240 x 2824	7 fps
GS3-U3-123S6C/M-C	12.3MP Sony IMX253 CMOS*	1.1"	3.45 µm Global	4096 x 3000	30 fps

*High performance Sony Pregius™ Global Shutter CMOS **High sensitivity Sony EXview HAD CCD II™

INTERFACE	USB 3.1 Gen 1 interface with screw locks for camera control, data, and power
GPIO	8-pin Hirose HR25 GPIO connector for power, trigger, strobe, PWM, and serial I/O: 1 opto-isolated input, 1 opto-isolated output, 2 bi-directional I/O pins
ADC	14-bit • 10/12-bit (GS3-U3-23S6, 32S4, 51S5, 89S6, 123S6) • 10-bit (GS3-U3-41C6)
IMAGE DATA FORMATS	Mono8, Mono12, Mono16 (all models) RGB, YUV411, YUV422, YUV444, Raw8, Raw12, Raw16 (color models)
PARTIAL IMAGE MODES	Pixel binning and region of interest (ROI) modes
GAMMA	0.50 to 4.00, programmable lookup table
TRIGGER MODES	Standard, bulb, multi-shot, overlapped, low smear mode (CCD models only)
IMAGE BUFFER	128 MB frame buffer
USER SETS	2 memory channels for custom camera settings
SIZE (WxHxD)	44 x 29 x 58 mm excluding lens holder (metal case)
MASS	90 g (Without optics or tripod mounting bracket)
POWER	5 V via USB 3.1 interface or 8-24 V via GPIO (external power is recommended for this model)
LENS MOUNT	C-mount
TEMPERATURE	-30° to 60°C (storage) • 0° to 50°C (operating)
WARRANTY	3 years

FLIR ORYX

10 Gigabit Ethernet Camera Features:
- 4K60 and beyond
- The latest Global shutter CMOS sensors at their maximum frame rates
- High density 12 pin GPIO
- IEEE 1588 Precision Time Protocol
- Designed and tested for continuous operation at 50°C

ORYX™

10 Gigabit Ethernet Camera

Model#	Sensor Specifications			Shutter	Max Res	Max FPS
ORX-10G-51S5M/C-C	5.0MP	Sony IMX250 CMOS*	2/3"	3.45 µm Global	2448 x 2048	163 fps
ORX-10G-89S6M/C-C	8.9MP	Sony IMX255 CMOS*	1"	3.45 µm Global	4096 x 2160	93 fps
ORX-10G-123S6M/C-C	12.3MP	Sony IMX253 CMOS*	1.1"	3.45 µm Global	4096 x 3000	68 fps

*High performance Sony Pregius™ Global Shutter CMOS

10 Gigabit Ethernet (10GBASE-T)	**INTERFACE**
GigE Vision	**MACHINE VISION STANDARD**
12 Pin Hirose GPIO connector for power, trigger strobe 2x Opto-isolated input, and output, 2x non-isolated bi-directional, serial port over non-isolated I/O, Auxiliary output (3.3V, 120 mA max)	**GPIO**
8-bit • 10-bit • 12-bit	**ADC**
Pixel Binning, Decimation, and Region of Interest	**PARTIAL IMAGE MODES**
Color correction Matrix, gamma, saturation, and sharpness	**IMAGE PROCESSING**
0.5 to 4, programmable lookup table	**GAMMA**
External Trigger, Software Trigger	**TRIGGER MODES**
Logic Blocks, Counter and Timers, Sequencer with 8 user sets	**TRIGGER LOGIC**
IEEE 1588 Precision Time Protocol	**TIME SYNCHRONIZATION PROTOCOL**
240MB	**IMAGE BUFFER**
2 memory channels for custom camera settings	**USER SETS**
60x60x100mm excluding lens holder, without optics (metal case)	**SIZE (WXHXD)**
Externally Powered over GPIO (12-24V) 12W Max	**POWER**
C-mount	**LENS MOUNT**
-30°C to 60°C (storage) • 0°C to 50°C (operating)	**TEMPERATURE**
3 years	**WARRANTY**

High Speed Interface

Capture global shutter 4K images at 60FPS, and minimize cycle times with low latency image transfer

Reliability and Simplicity

Proven and reliable 10GBASE-T interface supports cable lengths over 50 m using widely available hardware

Flexibility for Integrators

GigE Vision compatibility and advanced on-camera features give integrators the tools to quickly develop innovative solutions

4K60 and beyond

GigE Camera Features:

- Unique selection of CMOS and CCD sensors
- Supports GigE Vision 1.2
- Industry's most compact sizes
- GigE image filter driver for reduced latency and maximized bandwidth
- Firmware versions updatable in the field
- On-board temperature, power sensors, and status LED

BLACKFLY® S

UP TO 20 MP CMOS IN AN ICE CUBE

Model#	Sensor	Specifications			Shutter	Max Res	Max FPS
BFS-PGE-04S2C/M-CS	0.4MP	Sony IMX287 CMOS*	1/2.9"	6.9 µm	Global	720 x 540	291 fps
BFS-PGE-13Y3C/M-C	1.3MP	ON Semi PYTHON 1300 CMOS	1/2"	4.8 µm	Global	1280 x 1024	84 fps
BFS-PGE-16S2C/M-CS	1.6MP	Sony IMX273 CMOS*	1/2.9"	3.45 µm	Global	1440 x 1080	73 fps
BFS-PGE-23S3C/M-C	2.3 MP	Sony IMX392 CMOS*	1/2.3"	3.45 µm	Global	1920 x 1200	49 fps
BFS-PGE-31S4C/M-C	3.2MP	Sony IMX265 CMOS*	1/1.8"	3.45 µm	Global	2048 x 1536	35 fps
BFS-PGE-50S5C/M-C	5.0MP	Sony IMX264 CMOS*	2/3"	3.45 µm	Global	2448 x 2048	24 fps
BFS-PGE-51S5P-C	5.0 MP	Sony IMX250MZR CMOS*	2/3"	3.45 µm	Global	2448 x 2048	24 fps
BFS-PGE-88S6C/M-C	8.9 MP	Sony IMX267 CMOS*	1"	3.45 µm	Global	4096 x 2160	13.5 fps
BFS-PGE-122S6C/M-C	12.3 MP	Sony IMX304 CMOS*	1.1"	3.45 µm	Global	4096 x 3000	9.7 fps
BFS-PGE-200S6M/C-C	20 MP	Sony IMX183 CMOS*	1"	2.4 µm	Rolling	5472 x 3648	6.1 fps
BFS-GE-16S2M/C-BD2[1]	1.6 MP	Sony IMX273 CMOS*	1/2.9"	3.45 µm	Global	1440 x 1080	78 fps
BFS-PGE-70S7C/M-C[1]	7.1 MP	Sony IMX428 CMOS*	1.1"	4.5 µm	Global	3208 x 2200	17 fps

[1]Coming Soon

*High performance Sony Pregius™ Global Shutter CMOS

BLACKFLY®

ULTRA-COMPACT POE CAMERA

Model#	Sensor	Specifications			Shutter	Max Res	Max FPS
BFLY-PGE-03S2C/M-CS	0.3MP	Sony ICX424 CCD	1/3"	7.4 µm	Global	648 x 488	84 fps
BFLY-PGE-03S3C/M-CS	0.3MP	Sony ICX414 CCD	1/2"	9.9 µm	Global	648 x 488	90 fps
BFLY-PGE-05S2C/M-CS	0.5MP	Sony ICX693 CCD	1/3"	6.0 µm	Global	808 x 608	50 fps
BFLY-PGE-09S2C/M-CS	0.9MP	Sony ICX692 CCD**	1/3"	4.08 µm	Global	1288 x 728	30 fps
BFLY-PGE-12A2C/M-CS	1.2MP	Aptina AR0134 CMOS	1/3"	3.75 µm	Global	1280 x 960	52 fps
BFLY-PGE-13S2C/M-CS	1.3MP	Sony ICX445 CCD*	1/3"	3.75 µm	Global	1288 x 964	30 fps
BFLY-PGE-13H2C/M-CS	1.3MP	Sharp RJ33J3/RJ33J4 CCD	1/3"	3.75 µm	Global	1288 x 964	30 fps
BFLY-PGE-13E4C/M-CS	1.3MP	e2v EV76C560 CMOS	1/1.8"	5.3 µm	Global	1280 x 1024	60 fps
BFLY-PGE-14S2C-CS	1.4MP	Sony IMX104 CMOS	1/3"	3.75 µm	Rolling	1296 x 1032	60 fps
BFLY-PGE-20E4C/M-CS	2.0MP	e2v EV76C570 CMOS	1/1.8"	4.5 µm	Global	1600 x 1200	50 fps
BFLY-PGE-23S2C-CS	2.3MP	Sony IMX136 CMOS	1/2.8"	2.8 µm	Rolling	1920 x 1200	27 fps
BFLY-PGE-23S6C/M-C	2.3MP	Sony IMX249 CMOS***	1/1.2"	5.86 µm	Global	1920 x 1200	41 fps
BFLY-PGE-31S4M/C-C[1]	3.2MP	Sony IMX265 CMOS***	1/1.8"	3.45 µm	Global	2048 x 1536	35 fps
BFLY-PGE-50A2C/M-CS	5.0MP	Aptina MT9P006/031 CMOS	1/2.5"	2.2 µm	Rolling	2592 x 1944	13 fps
BFLY-PGE-50H5C/M-C	5.0MP	Sharp RJ32S4/S3AA0DT CCD	2/3"	3.45 µm	Global	2448 x 2048	7.5 fps
BFLY-PGE-50S5M/C-C[1]	5.0MP	Sony IMX264 CMOS***	2/3"	3.45 µm	Global	2448 x 2048	22 fps

*High sensitivity Sony EXview HAD CCD™ **High sensitivity Sony EXview HAD CCD II™ ***High performance Sony Pregius™ Global Shutter CMOS

	BFS	BFLY
INTERFACE	Gigabit Ethernet interface with screw locks for camera control and data; Power over Ethernet	Gigabit Ethernet interface with screw locks for camera control and data; Power over Ethernet
GPIO	6-pin Hirose HR10A-7R-6PB GPIO connector for trigger, strobe, and power. 1 opto-isolated input, 1 opto-isolated output. 1 bi-directional I/O pin, 1 input pin.	6-pin Hirose HR10A-7R-6PB GPIO connector for trigger, strobe, and power. 1 opto-isolated input, 1 opto-isolated output
ADC	12-bit • 10-bit (BFS-PGE-13Y3)	10-bit (BFLY-PGE-13E4, BFLY-PGE-20E4) • 12-bit
IMAGE DATA FORMATS	Mono8, Mono16, Bayer8, Bayer16, RGB8, YCbCr8, YCbCr411_8, YCbCr422_8	Mono8, Mono12, Mono16, Raw8, Raw12, Raw16 (all models) / RGB, YUV411, YUV422, YUV 444 (color models)
PARTIAL IMAGE MODES	Pixel binning and region of interest (ROI) modes	Pixel binning and region of interest (ROI) modes
GAMMA	0.50 to 4.00, programmable lookup table	0.50 to 4.00, programmable lookup table
TRIGGER MODES	External trigger and software trigger	Standard, bulb (except BFLY-PGE-05S2, BFLY-PGE-09S2, BFLY-PGE-12A2, BFLY-PGE-13E4, BFLY-PGE-20E4) overlapped (except BFLY-PGE-12A2, BFLY-PGE-13E4, BFLY-PGE-14S2, BFLY-PGE-20E4, BFLY-PGE-50A2), multi-shot, low smear mode (CCD models only)
TIME SYNCHRONIZATION PROTOCOL	IEEE 1588 Precision Time Protocol	
IMAGE BUFFER	240 MB	16 MB frame buffer
USER SETS	2 memory channels for custom camera settings	2 memory channels for custom camera settings
SIZE (WxHxD)	29 x 29 x 30 mm excluding lens holder (metal case)	29 x 29 x 30 mm excluding lens holder, without optics (metal case)
MASS	36g (Without optics or tripod mounting bracket)	36 grams (without optics or tripod mounting bracket)
POWER	Standard voltage via Power over Ethernet (PoE) or 8 - 24 V via GPIO interface, < 2.5 W	Standard voltage via Power over Ethernet (PoE) or 5 - 16 V via GPIO interface, < 2.5 W
LENS MOUNT	C-mount / CS-mount (5 mm C-mount adapter sold separately)	C-mount / CS-mount (5 mm C-mount adapter sold separately)
TEMPERATURE	-30° to 60°C (storage) • 0° to 50°C (operating)	-30° to 60°C (storage) • 0° to 45°C (operating)
WARRANTY	3 years	3 years

FLEA®3

ULTRA-COMPACT GIGE CAMERA

Model#	Sensor Specifications			Shutter	Max Res	Max FPS
FL3-GE-03S1C/M-C	0.3MP	Sony ICX618 CCD*	1/4" 5.6 µm	Global	648 x 488	120 fps
FL3-GE-03S2C/M-C	0.3MP	Sony ICX424 CCD	1/3" 7.4 µm	Global	648 x 488	82 fps
FL3-GE-08S2C/M-C	0.8MP	Sony ICX204 CCD	1/3" 4.65 µm	Global	1032 x 776	31 fps
FL3-GE-13S2C/M-C/CS	1.3MP	Sony ICX445 CCD*	1/3" 3.75 µm	Global	1288 x 964	31 fps
FL3-GE-14S3C/M-C	1.4MP	Sony ICX267 CCD	1/2" 4.65 µm	Global	1384 x 1032	18 fps
FL3-GE-20S4C/M-C	2.0MP	Sony ICX274 CCD	1/1.8" 4.4 µm	Global	1624 x 1224	15 fps
FL3-GE-28S4C/M-C	2.8MP	Sony ICX687 CCD**	1/1.8" 3.69 µm	Global	1928 x 1448	14 fps
FL3-GE-50S5C/M-C	5.0MP	Sony ICX655 CCD	2/3" 3.45 µm	Global	2448 x 2048	8 fps

*High sensitivity Sony EXview HAD CCD™ **High sensitivity Sony EXview HAD CCD II™

GRASSHOPPER®3

POE, FAST, HIGH-RESOLUTION IMAGING

Model#	Sensor Specifications			Shutter	Max Res	Max FPS
GS3-PGE-23S6C/M-C	2.3MP	Sony IMX174 CMOS*	1/1.2" 5.86 µm	Global	1920 x 1200	45 fps
GS3-PGE-50S5C/M-C	5.0MP	Sony ICX625 CCD	2/3" 3.45 µm	Global	2448 x 2048	15 fps
GS3-PGE-60S6C/M-C	6.0MP	Sony ICX694 CCD**	1" 4.54 µm	Global	2736 x 2192	13 fps
GS3-PGE-91S6C/M-C	9.1MP	Sony ICX814 CCD**	1" 3.69 µm	Global	3376 x 2704	9 fps

*High performance Sony Exmor CMOS™ **High sensitivity Sony EXview HAD CCD II™

FLEA®3	GRASSHOPPER®3	
Gigabit Ethernet interface with screw locks for camera control and data	Gigabit Ethernet interface with screw locks for camera control and data; Power over Ethernet	INTERFACE
8-pin Hirose HR25 GPIO connector for power, trigger, strobe, PWM, and serial I/O, 1 opto-isolated input, 1 opto-isolated output, 2 bi-directional I/O pins	8-pin Hirose HR25 GPIO connector for power, trigger, strobe, PWM, and serial I/O 1 opto-isolated input,1 opto-isolated output, 2 bi-directional I/O pins	GPIO
12-bit	10/12-bit (GS3-PGE-23S6) • 14-bit	ADC
Y8, Y16, Mono8, Mono12, Mono16 (all models) / RGB, YUV411, YUV422, YUV 444, Raw8, Raw12, Raw16 (color models)	Mono8, Mono12, Mono16 (all models) RGB, YUV411, YUV422, YUV444, Raw8, Raw12, Raw16 (color models)	IMAGE DATA FORMATS
Pixel binning and region of interest (ROI) modes	Pixel binning and region of interest (ROI) modes	PARTIAL IMAGE MODES
0.50 to 4.00, programmable lookup table	0.50 to 4.00, programmable lookup table	GAMMA
Standard, bulb, skip frames, multi-exposure preset, multi-exposure pulse width, overlapped, multi-shot	Standard, bulb, overlapped, multi-shot, low smear mode (CCD models only)	TRIGGER MODES
32 MB frame buffer	128 MB frame buffer	IMAGE BUFFER
2 memory channels for custom camera settings	2 memory channels for custom camera settings	USER SETS
29x29x30 mm excluding lens holder, without optics (metal case)	44x29x58 mm excluding lens holder and connectors (metal case)	SIZE (WxHxD)
38 grams (without optics or tripod mounting bracket)	90 grams (without optics or tripod mounting bracket)	MASS
Standard voltage via Power over Ethernet (PoE) or 5 - 24 V via GPIO interface, < 2.5 W	Standard voltage via Power over Ethernet (PoE) or 5 - 24 V via GPIO interface, < 2.5 W	POWER
C-mount (FL3-GE-13S2 also available with CS-mount)	C-mount	LENS MOUNT
-30° to 60°C (storage) • 0° to 45°C (operating)	-30° to 60°C (storage) • 0° to 50°C (operating)	TEMPERATURE
3 years	3 years	WARRANTY

Ladybug Family Key Features

- 360° degree video streaming
- Covers 90% of visual sphere; 6 sensors each camera
- Full featured SDK including dynamic stitching & image stabilization
- Independent imaging control CMOS and CCD settings controlled individually or in unison
- Pre-calibrated for ease of use
- High dynamic range mode continuously cycles through a series of camera shutter and gain settings

LADYBUG® 5+

8K30 OR 4K60, 30 MP, GLOBAL SHUTTER

Model#	Sensor Specifications	Shutter	Max Res Per Sensor	Max FPS
LD5P-U3-51S5C-R LD5P-U3-51S5C-B	30MP Sony IMX264 CMOS 2/3" 3.45 µm	Global	2448 x 2048	2448 x 2048 @ 30 FPS 2448 x 1024 @ 60 FPS

LADYBUG® 3

12MP, WATER RESISTANT

Model#	Sensor Specifications	Shutter	Max Res Per Sensor	Max FPS
LD3-20S4C-33	12MP Sony ICX274 CCD 1/1.8"	4.4 µm Global	1600 x 1200	16 FPS Compressed, 6.5 FPS Uncompressed
			1600 x 800	32 FPS

	LADYBUG® 5+	LADYBUG® 3
INTERFACE	USB 3.1 Gen 1 interface with screw locks for camera control and data	IEEE 1394b interface with screw locks for camera control, data, and power
GPIO	12-pin GPIO connector for external trigger input, strobe output, and camera power	8-pin GPIO connector for external trigger, strobe, serial port, or external power
OPTICS	Six high quality f2.5, 4.4 mm focal length lenses	Six high quality 3.3 mm focal length lenses
SPHERICAL DISTANCE	Calibrated from 2 m to infinity	Calibrated at 20 m
FOCUS DISTANCE	~200 cm. Objects have an acceptable sharpness from ~60 cm to infinity	~200 cm. Objects have an acceptable sharpness from ~60 cm to infinity
ADC	12-bit	12-bit
IMAGE DATA FORMATS	Raw8, Raw12 in uncompressed and JPEG	Raw8, Mono8, JPEG8
IMAGE DATA OUTPUT	8-, 12-, or 16-bit, Raw or JPEG compressed	8-bit raw Bayer (color) digital data
GAIN RANGE	Automatic/manual/one-push modes for 8-bit formats; manual mode for 12-bit formats; 0 - 18 dB	Automatic/manual/one-push/ 0dB to 24dB
GAMMA	0.50 to 4.00	0.50 to 4.00
TRIGGER MODES	Standard, bulb, skip frames, overlapped, multi-shot	Standard, bulb, skip frames, overlapped, multi-shot
HIGH DYNAMIC RANGE	Cycle 4 gain and exposure presets	Cycle 4 gain and exposure presets
EXPOSURE RANGE	Global shutter; Automatic/manual/one-push/extended shutter modes 0.02 ms to 2 seconds (extended shutter)	Global shutter; Automatic/manual/one-push/extended shutter modes 0.01 ms to 4.2 s (extended shutter mode)
IMAGE PROCESSING	Shutter, gain, white balance, gamma and JPEG compression, are programmable via software	Shutter, gain, white balance, gamma & JPEG compression, programmable via software
CASE TYPE	Single unit, water resistant	Single unit, water resistant
CASE MATERIAL	Machined aluminum housing, anodized red or black	Machined aluminum housing, anodized red or black
ENVIRONMENTAL SENSORS	Temperature, Barometer, Humidity, Accelerometer, Compass	N/A
SIZE (WXHXD)	197 mm diameter, 160 mm height (with lens hoods)	122 x 141 x 133 mm
MASS	3000 g	2414 g
POWER	12-24 V, 13 W via GPIO (external power required)	8-30 V, 7.2 W at 12 V via IEEE 1394b
TEMPERATURE	-30° to 60°C (storage) • -20° to 50°C (operating)	-30° to 60°C (storage) • 0° to 45°C (operating)
WARRANTY	2 years	1 year

FREQUENTLY ASKED QUESTIONS

What is included with my camera?

During your camera selection please be mindful of which accessories are included and which accessories are not included with the camera.

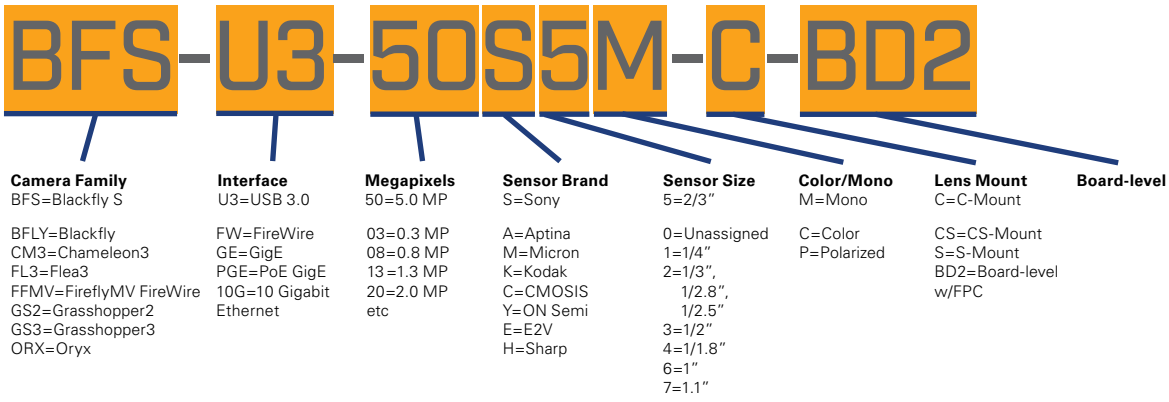
Here is a quick table guide for your reference:

USB3 VISION CAMERAS	Tripod Adapter	5mm C-Mount Adapter	Cables	Lens
Blackfly S USB3	No	No	No	No
Blackfly USB3	No	No	No	No
Chameleon3 USB3	No	No	No	No
Flea3 USB3	Yes	Yes for CS-mount models	No	No
Grasshopper3 USB3	Yes	N/A (no CS-mount models)	No	No

GIGE VISION CAMERAS	Tripod Adapter	5mm C-Mount Adapter	Cables	Lens
Oryx GigE	N/A	No	No	No
Blackfly GigE	No	No	No	No
Blackfly S GigE	No	No	No	No
Flea3 GigE	Yes	Yes for CS-mount models	No	No
Grasshopper2 GigE	Yes	N/A (no CS-mount models)	No	No
Grasshopper3 GigE	Yes	N/A (no CS-mount models)	No	No

What do your model numbers mean?

Here is one example of our model numbers and what each section means. Understanding this will give you a quick explanation of the model's specifications and help you when comparing models.



Where can I get more technical support?

You can search our online Knowledge Base for answers to camera issues here: www.flir.com/knowledgebase
You can contact our support team directly and email them your issue. We have support teams staffed at our North America, Germany, China and Japan offices ready to assist with your cameras. You can contact our support team directly at mv-support@flir.com.

Where can I get more sales assistance?

Pricing and web purchase are available at www.flir.com/mv. You can also email us, we're always happy to help: mv-sales@flir.com

	MODEL NUMBER	INTERFACE	SENSOR TYPE	OPTICAL FORMAT	PIXEL SIZE	MAX RES	MAX FPS
BLACKFLY S Page 3	BFS-U3-04S2C/M-CS	USB 3.1 Gen 1	Sony IMX287 CMOS	1/2.9″	6.9 µm	720 x 540	523 fps
	BFS-U3-13Y3C/M-C	USB 3.1 Gen 1	ON Semi PYTHON 1300 CMOS	1/2″	4.8µm	1280 x 1024	170 fps
	BFS-U3-16S2C/M-CS	USB 3.1 Gen 1	Sony IMX273 CMOS	1/2.9″	3.45 µm	1440 x 1080	241 fps
	BFS-U3-23S3C/M-C	USB 3.1 Gen 1	Sony IMX392 CMOS	1/2.3″	3.45 µm	1920 x 1200	164 fps
	BFS-U3-31S4C/M-C	USB 3.1 Gen 1	Sony IMX265 CMOS	1/1.8″	3.45 µm	2048 x 1536	55 fps
	BFS-U3-32S4C/M-C	USB 3.1 Gen 1	Sony IMX252 CMOS	1/1.8″	3.45 µm	2048 x 1536	118 fps
	BFS-U3-50S5M/C-C	USB 3.1 Gen 1	Sony IMX264 CMOS	2/3″	3.45 µm	2448 x 2048	35 fps
	BFS-U3-51S5P-C	USB 3.1 Gen 1	Sony IMX250MZR CMOS	2/3″	3.45 µm	2448 x 2048	75 fps
	BFS-U3-51S5C/M-C	USB 3.1 Gen 1	Sony IMX250 CMOS	2/3″	3.45 µm	2448 x 2048	75 fps
	BFS-U3-63S4C/M-C	USB 3.1 Gen 1	Sony IMX178 CMOS	1/1.8″	2.4 µm	3072 x 2064	59 fps
	BFS-U3-70S7C/M-C	USB 3.1 Gen 1	Sony IMX428CMOS	1″	4.5 µm	3208 x 2200	51 fps
	BFS-U3-88S6C/M-C	USB 3.1 Gen 1	Sony IMX267 CMOS	1″	3.45 µm	4096 x 2160	32 fps
	BFS-U3-89S6C/M-C	USB 3.1 Gen 1	Sony IMX255 CMOS	1″	3.45 µm	4096 x 2160	43 fps
	BFS-U3-120S4C/M-CS	USB 3.1 Gen 1	Sony IMX226 CMOS	1/1.7″	1.85 µm	4000 x 3000	32 fps
	BFS-U3-122S6C/M-C	USB 3.1 Gen 1	Sony IMX304 CMOS	1.1″	3.45 µm	4096 x 3000	23 fps
	BFS-U3-123S6C/M-C	USB 3.1 Gen 1	Sony IMX253 CMOS	1.1″	3.45 µm	4096 x 3000	30 fps
	BFS-U3-200S6C/M-C	USB 3.1 Gen 1	Sony IMX183 CMOS	1″	2.4 µm	5472 x 3648	18 fps
CHAMELEON3 Page 4	CM3-U3-13S2C/M-CS	USB 3.1 Gen 1	Sony ICX445 CCD	1/3″	3.75µm	1288 x 964	30 fps
	CM3-U3-13Y3C/M-CS	USB 3.1 Gen 1	ON Semi PYTHON 1300 CMOS	1/2″	4.8µm	1280 x 1024	149 fps
	CM3-U3-28S4C/M-CS	USB 3.1 Gen 1	Sony ICX818 CCD	1/1.8″	3.69µm	1928 x 1448	13 fps
	CM3-U3-31S4C/M-CS	USB 3.1 Gen 1	Sony IMX265 CMOS	1/1.8″	3.45 µm	2048 x 1536	55 fps
	CM3-U3-50S5C/M-CS	USB 3.1 Gen 1	Sony IMX264 CMOS	2/3″	3.45 µm	2448 x 2048	35 fps
BLACKFLY Page 4	BFLY-U3-03S2C/M-CS	USB 3.1 Gen 1	Sony ICX424 CCD	1/3″	7.4µm	648 x 488	84 fps
	BFLY-U3-05S2C/M-CS	USB 3.1 Gen 1	Sony ICX693 CCD	1/3″	6.0µm	808 x 608	50 fps
	BFLY-U3-13S2C/M-CS	USB 3.1 Gen 1	Sony ICX445 CCD	1/3″	3.75µm	1288 x 964	30 fps
	BFLY-U3-20S4C/M-CS	USB 3.1 Gen 1	Sony ICX274 CCD	1/1.8″	4.4 µm	1624 x 1224	15 fps
	BFLY-U3-23S6C/M-C	USB 3.1 Gen 1	Sony IMX249 CMOS	1/1.2″	5.86 µm	1920 x 1200	41 fps
	BFLY-U3-50H5C/M-C	USB 3.1 Gen 1	Sharp RJ32S3AA0DT CCD	2/3″	3.45 µm	2448 x 2048	7.5 fps
GRASSHOPPER3 Page 5	GS3-U3-14S5C/M-C	USB 3.1 Gen 1	Sony ICX285 CCD	2/3″	6.45µm	1384 x 1036	30 fps
	GS3-U3-15S5C/M-C	USB 3.1 Gen 1	Sony ICX825 CCD	2/3″	6.45µm	1384 x 1032	45 fps
	GS3-U3-23S6C/M-C	USB 3.1 Gen 1	Sony IMX174 CMOS	1/1.2″	5.86µm	1920 x 1200	163 fps
	GS3-U3-28S4C/M-C	USB 3.1 Gen 1	Sony ICX687 CCD	1/1.8″	3.69µm	1928 x 1448	26 fps
	GS3-U3-28S5C/M-C	USB 3.1 Gen 1	Sony ICX674 CCD	2/3″	4.54µm	1920 x 1440	26 fps
	GS3-U3-32S4C/M-C	USB 3.1 Gen 1	Sony IMX252 CMOS	1/1.8″	3.45µm	2048 x 1536	121 fps
	GS3-U3-41S4C/M-C	USB 3.1 Gen 1	Sony ICX808 CCD	1/1.8″	3.1µm	2016 x 2016	18 fps
	GS3-U3-41C6NIR-C	USB 3.1 Gen 1	CMOSIS CMV4000-3E12 CMOS	1″	5.5µm	2048 x 2048	90 fps
	GS3-U3-41C6C/M-C	USB 3.1 Gen 1	CMOSIS CMV4000-3E5 CMOS	1″	5.5µm	2048 x 2048	90 fps
	GS3-U3-50S5C/M-C	USB 3.1 Gen 1	Sony ICX625 CCD	2/3″	3.45µm	2448 x 2048	15 fps
	GS3-U3-51S5C/M-C	USB 3.1 Gen 1	Sony IMX250 CMOS	2/3″	3.45µm	2448 x 2048	75 fps
	GS3-U3-60S6C/M-C	USB 3.1 Gen 1	Sony ICX694 CCD	1″	4.54µm	2736 x 2192	13 fps
	GS3-U3-60Q6C/M-C	USB 3.1 Gen 1	Sony ICX694 CCD	1″	4.54µm	2736 x 2192	25 fps
	GS3-U3-89S6C/M-C	USB 3.1 Gen 1	Sony IMX255 CMOS	1″	3.45µm	4096 x 2160	43 fps
	GS3-U3-91S6C/M-C	USB 3.1 Gen 1	Sony ICX814 CCD	1″	3.69µm	3376 x 2704	9 fps
	GS3-U3-120S6C/M-C	USB 3.1 Gen 1	Sony ICX834 CCD	1″	3.1µm	4240 x 2824	7 fps
	GS3-U3-123S6C/M-C	USB 3.1 Gen 1	Sony IMX253 CMOS	1.1″	3.45µm	4096 x 3000	30 fps
ORYX Page 6	ORX-10G-51S5C/M-C	10 Gigabit Ethernet	Sony IMX250 CMOS	2/3″	3.45µm	2448 x 2048	163 fps
	ORX-10G-89S6C/M-C	10 Gigabit Ethernet	Sony IMX255 CMOS	1″	3.45µm	4096 x 2160	93 fps
	ORX-10G-123S6C/M-C	10 Gigabit Ethernet	Sony IMX253 CMOS	1.1″	3.45µm	4096 x 3000	68 fps
BLACKFLY S Page 7	BFS-PGE-04S2C/M-CS	GigE PoE	Sony IMX287 CMOS	1/2.9″	6.9 µm	720 x 540	291 fps
	BFS-PGE-13Y3C/M-C	GigE PoE	ON Semi PYTHON 1300 CMOS	1/2″	4.8 µm	1280 x 1024	84 fps
	BFS-PGE-16S2C/M-CS	GigE PoE	Sony IMX273 CMOS	1/2.9″	3.45 µm	1440 x 1080	73 fps
	BFS-PGE-23S3C/M-C	GigE PoE	Sony IMX392 CMOS	1/2.3″	3.45 µm	1920 x 1200	49 fps
	BFS-PGE-31S4C/M-C	GigE PoE	Sony IMX265 CMOS	1/1.8″	3.45 µm	2048 x 1536	35 fps
	BFS-PGE-50S5C/M-C	GigE PoE	Sony IMX264 CMOS	2/3″	3.45 µm	2448 x 2048	24 fps
	BFS-PGE-51S5P-C	GigE PoE	Sony IMX250MZR CMOS	2/3″	3.45 µm	2448 x 2048	24 fps
	BFS-PGE-70S7C/M-C	GigE PoE	Sony IMX428 CMOS	1″	4.5 µm	3208 x 2200	17 fps
	BFS-PGE-88S6C/M-C	GigE PoE	Sony IMX267 CMOS	1″	3.45 µm	4096 x 2160	11 fps
	BFS-PGE-122S6C/M-C	GigE PoE	Sony IMX304 CMOS	1.1″	3.45 µm	4096 x 3000	8 fps
	BFS-PGE-200S6C/M-C	GigE PoE	Sony IMX183 CMOS	1″	2.4 µm	5472 x 3648	6.1 fps
BLACKFLY Page 7	BFLY-PGE-03S2C/M-CS	GigE PoE	Sony ICX424 CCD	1/3″	7.4µm	648 x 488	84 fps
	BFLY-PGE-03S3C/M-CS	GigE PoE	Sony ICX414 CCD	1/2″	9.9µm	648 x 488	90 fps
	BFLY-PGE-05S2C/M-CS	GigE PoE	Sony ICX693 CCD	1/3″	6.0µm	808 x 608	50 fps
	BFLY-PGE-09S2C/M-CS	GigE PoE	Sony ICX692 CCD	1/3″	4.08µm	1288 x 728	30 fps
	BFLY-PGE-12A2C/M-CS	GigE PoE	Aptina AR0134 CMOS	1/3″	3.75µm	1280 x 960	52 fps
	BFLY-PGE-13S2C/M-CS	GigE PoE	Sony ICX445 CCD	1/3″	3.75µm	1288 x 964	30 fps
	BFLY-PGE-13H2C/M-CS	GigE PoE	Sharp RJ33J4/RJ33J3 CCD	1/3″	3.75µm	1288 x 964	30 fps
	BFLY-PGE-13E4C/M-CS	GigE PoE	e2v EV76C560 CMOS	1/1.8″	5.3µm	1280 x 1024	60 fps
	BFLY-PGE-14S2C-CS	GigE PoE	Sony IMX104 CMOS	1/3″	3.75µm	1296 x 1032	60 fps
	BFLY-PGE-20E4C/M-CS	GigE PoE	e2v EV76C570 CMOS	1/1.8″	4.5µm	1600 x 1200	50 fps
	BFLY-PGE-23S2C-CS	GigE PoE	Sony IMX136 CMOS	1/2.8″	2.8µm	1920 x 1200	27 fps
	BFLY-PGE-23S6C/M-C	GigE PoE	Sony IMX249 CMOS	1/1.2″	5.86µm	1920 x 1200	41 fps
	BFLY-PGE-31S4C/M-C	GigE PoE	Sony IMX265 CMOS	1/1.8″	3.45 µm	2048 x 1536	35 fps
	BFLY-PGE-50A2C/M-CS	GigE PoE	Aptina MT9P006/031 CMOS	1/2.5″	2.2µm	2592 x 1944	13 fps
	BFLY-PGE-50H5C/M-C	GigE PoE	Sharp RJ32S4/S3AA0DT CCD	2/3″	3.45µm	2448 x 2048	7.5 fps
	BFLY-PGE-50S5C/M-C	GigE PoE	Sony IMX264 CMOS	2/3″	3.45 µm	2448 x 2048	22 fps

SHUTTER	GPIO	LENS MOUNT	A/D CONVERTER	IMAGE DATA OUTPUT	ON-BOARD MEMORY	SIZE	OPERATING TEMP	WARRANTY
Global	6-pin Hirose	CS	10/12-bit ADC	8, 10, 12, 16, 24, 32-bit	240 MB frame buffer	29 x 29 x 30 mm	0° to 50° C	3 years
Global	HR10A-7R-6PB	C	10-bit ADC		6 MB flash memory			
Global		CS	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Rolling/Global Reset		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Rolling/Global Reset		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	10/12-bit ADC					
Rolling/Global Reset		C	10/12-bit ADC					
Global	9-pin JST	CS	12-bit ADC	8, 12, 16, 24-bit	16 MB frame buffer	44 x 35 x 19.5 mm	0° to 45° C	3 years
Global		CS	12-bit ADC		1 MB flash memory			
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global	6-pin Hirose	CS	12-bit ADC	8, 12, 16, 24-bit	16 MB frame buffer	29 x 29 x 30 mm	0° to 45° C	3 years
Global	HR10A-7R-6PB	CS	12-bit ADC		1 MB flash memory			
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		C	10/12-bit ADC					
Global		C	12-bit ADC					
Global	8-pin Hirose HR25	C	14-bit ADC	8, 12, 16, 24-bit	128 MB frame buffer	44 x 29 x 58 mm	0° to 50° C	3 years
Global		C	14-bit ADC		2 MB flash memory			
Global		C	10/12-bit ADC					
Global		C	14-bit ADC					
Global		C	14-bit ADC					
Global		C	10/12-bit ADC					
Global		C	14-bit ADC					
Global		C	10-bit ADC					
Global		C	10-bit ADC					
Global		C	14-bit ADC					
Global		C	10/12-bit ADC					
Global		C	14-bit ADC					
Global		C	14-bit ADC					
Global		C	10/12-bit ADC					
Global		C	14-bit ADC					
Global		C	14-bit ADC					
Global		C	10/12-bit ADC					
Global	12-pin Hirose	C	8/10/12-bit ADC	8, 10, 12, 16, 24-bit	256 MB frame buffer	60 x 60 x 100 mm	0° to 50° C	3 years
Global		C	8/10/12-bit ADC		32 MB flash memory			
Global		C	8/10/12-bit ADC					
Global	6-pin Hirose	CS	10/12-bit ADC	8, 10, 12, 16, 24-bit	240 MB frame buffer	29 x 29 x 30 mm	0° to 50° C	3 years
Global	HR10A-7R-6PB	C	10-bit ADC		6 MB flash memory			
Global		CS	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					
Rolling/Global Reset		C	10/12-bit ADC					
Global	6-pin Hirose	CS	12-bit ADC	8, 12, 16, 24-bit	16 MB frame buffer	29 x 29 x 30 mm	0° to 45° C	3 years
Global	HR10A-7R-6PB	CS	12-bit ADC		512 KB flash memory			
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		CS	12-bit ADC					
Global		CS	10-bit ADC					
Rolling		CS	12-bit ADC					
Global		CS	10-bit ADC					
Rolling		CS	12-bit ADC					
Global		C	10/12-bit ADC					
Global		CS	12-bit ADC					
Rolling/Global Reset		CS	12-bit ADC					
Global		C	12-bit ADC					
Global		C	12-bit ADC					

MULTIPLE PLATFORM

- **WINDOWS**® 32/64-bit XP, 7, 8, 10
- **LINUX**® Ubuntu® 32/64-bit ARM
- **Mac OS***
  *Coming Soon

MULTIPLE INTERFACES

This SDK provides the same programming interface across USB3 Vision and GigE Vision cameras.

MULTIPLE LANGUAGES

- **C, C++, C#**
- **Visual Basic .NET**
- **DirectShow**
- **Cognex**
- **Python**

SPINNAKER SDK

The Spinnaker SDK is FLIR's next generation GenICam3 API library built for machine vision developers. It features an intuitive GUI called SpinView, rich example code, and comprehensive documentation designed to help you build your application faster. Spinnaker is recommended for new projects.

BUILD FASTER

Engineered for faster development into your application and better forward compatibility.

ACCELERATED INTEGRATION

Unlock the power of GenICam3. Quickly build your own software and have UI customizations. Minimize future development time with Spinnaker's API forward compatibility.

DYNAMIC FEATURES

Simplify and improve performance by enabling camera events, imaging sequencer and programmable logic. Use chunk data to gather image metadata and validate system performance.

TRANSMISSION RELIABILITY

Superior image transfer control and bandwidth management offers greater flexibility and insight into all transmission pipeline layers. Review detailed diagnostics and take command of our advanced logging functionality.

ACCESSORY LIST

For the most up to date list, please visit www.flir.com/accessories

Model#	TRIPOD MOUNT / ENCLOSURES	BFLY-PGE	BFS-U3 BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-0003	Tripod Mount Adapter-3	■	■	■	■	■					
ACC-01-0011	Tripod Mount Adapter-11						■	■			
ACC-01-0012	Ladybug3 Desktop Mount								■	■	
ACC-01-0013	Ladybug3 Tripod Mount Adapter and Plugs								■		
ACC-01-0015	Ladybug5 Tripod Mount Adapter									■	

Model#	HOST ADAPTER CARDS	BFLY-PGE	BFS-U3 BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-1100	Intel PRO 1000 CT Gigabit Ethernet PCIe	■			■		■				
GIGE-PCIE2-2P02	Gigabit Ethernet PCIe PoE, 2 Port, Intel	■			■		■				
ACC-01-1201	Generic USB 3.1 Gen 1 PCIe 2.0 x1 2 Port Card		■	■		■		■		■	
ACC-01-1202	Generic USB 3.1 Gen 1 PCIe 2.0 x1 4 Port Card		■	■		■		■		■	
U3-PCIE2-2P01X	PGR USB 3.1 PCIe 2.0 x1 Card, Fresco, 2-port		■	■		■		■		■	
ACC-01-1203	USB 3.1 Gen 1 PCIe 2.0 x4 4 Port Card		■	■		■		■		■	
ACC-01-1101	Generic 10GBASE-T PCIe 2.0 x4 1 Port										■

Model#	CABLES	BFLY-PGE	BFS-U3 BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-2100	5 m CAT 5e Ethernet Locking Cable, High Flex	■			■		■				■
ACC-01-2101	4.5 meter CAT 5e Ethernet Cable	■			■		■				■
ACC-01-2300	3 m USB 3.0 Cable, Type-A to Micro-B (Locking)		■	■		■		■		■	
ACC-01-2301	5 m USB 3.0 Cable, Type-A to Micro-B (Locking)		■	■		■		■		■	
ACC-01-2302	5 m USB 3.0 Cable, Type-A to Micro-B (Locking) Industrial, 80°C		■	■		■		■		■	
ACC-01-2304	1 m USB 3.0 Cable, Type-A to Micro-B (Locking - Metal Connector)		■	■		■		■		■	
ACC-01-2305	3 m USB 3.0 Cable, Type-A to Micro-B (Locking - Metal Connector)		■	■		■		■		■	
ACC-01-2306	5 m USB 3.0 Cable, Type-A to Micro-B (Locking - Metal Connector)		■	■		■		■		■	

Model#	GPIO CONNECTORS	BFLY-PGE	BFS-U3 BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-3000	1.0 m, Circular 8-pin Prewired GPIO Hirose Conn.				■	■	■	■	■		
ACC-01-3001	12 pins, 0.1m GPIO Cable, Hirose HR10 Circular Connector										■
ACC-01-3005	4.5 m, Circular 8-pin Prewired GPIO Hirose Conn.				■	■	■	■	■		
ACC-01-3013	9-pin Prewired GPIO JST Connector			■							
ACC-01-3006	8-pin Circular Hirose HR25 GPIO Connector				■	■	■	■	■		
ACC-01-3009	1.0m, Circular 6-pin Prewired GPIO Hirose Conn.	■	■								
ACC-01-3010	4.5m, Circular 6-pin Prewired GPIO Hirose Conn.	■	■								
ACC-01-3011	6-pin Circular Hirose HR10 GPIO Connector	■	■								
ACC-01-3012	12-pin Circular Hirose GPIO Cable with Power Jack									■	

Model#	GENERIC OPTICS	BFLY-PGE	BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-4000	M12 Microlens 4MM (Boowon BW38BLF)			■							
ACC-01-4001	M12 Microlens 6MM (Boowon BW60BLF)			■							
ACC-01-4002	M12 Microlens 8MM (Boowon BW80H-1000)			■							

Model#	OPTIC MOUNTS	BFS-PGE	BFS-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-5004	C- to CS-Mount Mount 5mm Spacer Adapter	■	■	■	■	■					
ACC-01-5005	CS- to M12 Microlens Adapter			■	■	■					
ACC-01-5006	Cast Metal M12 Microlens Holder			■							
ACC-01-5007	Cast Metal M12 Microlens Holder with IR Filter			■							

Model#	HUBS	BFLY-PGE	BFS-U3 BFLY-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-6000	4-Port USB 3.0 Hub, Screw Locks, Ext Power Adap.		■	■		■		■			
ACC-01-6001	USB 3.1 Gen 1 Hub, VIA VL812, Micro B to Standard A, 1-port with screw locks		■	■		■		■		■	

Model#	POWER SUPPLY (PS) / MISC	BFS-PGE	BFS-U3	CM3-U3	FL3-GE	FL3-U3	GS3-PGE	GS3-U3	LD3	LD5	ORYX
ACC-01-9009	12V 1.5A Wall-Mount PS, Plug Adapters, HR25 GPIO Harness				■		■	■			
ACC-01-9011	12V 1.5A Wall-Mount PS, Plug Adapters, HR10 GPIO Harness	■									
ACC-01-9012	19.6W Single Port PoE Injector with NA power cord	■					■				
ACC-01-9013	12Pin, 18W Power supply										■

Model#	REGULAR LENS
LENS-15F5-125C	Fujinon fixed focal length 12.5mm C-mount lens for 2/3" sensors (HF12.5HA-1B)
LENS-15F5-250C	Fujinon fixed focal length 25mm C-mount lens for 2/3" sensors (HF25HA-1B)
LENS-15F3-60C	Fujinon fixed focal length 6mm C-mount lens for 1/2" sensors (DF6HA-1B)
LENS-V500F2CS	Fujinon vari-focal 15-50mm CS-mount lens, for 1/3" sensors (YV3.3x15SA-2)

Model#	HIGH RESOLUTION LENS
LENS-50F5-125C	Fujinon fixed focal length 12.5mm C-mount lens for 2/3" sensors (HF12.5SA-1)
LENS-80C7C	Computar 8mm fixed focal length C-mount lens, for 1" sensors (V0828-MPY)
LENS-160T5C	Tamron fixed focal length 16mm C-mount lens for 2/3" sensors (23FM16SP)
LENS-80T4C	Tamron fixed focal length 8mm C-mount lens for 1/1.8" sensors (MF118FM08)
LENS-80T6C	Tamron fixed focal length 8mm C-mount lens for 1.1" sensors (MF111FM08)
LENS-120C7C	Computar 12mm fixed focal length C-mount lens, for 1" sensors (V1228-MPY)
LENS-120T6C	Tamron 12mm fixed focal length C-mount lens, for 1/1.2" and 2/3" sensors (M112FM12)
LENS-160T4C	Tamron fixed focal length 16mm C-mount lens for 1/1.8" sensors (MF118FM16)
LENS-160E6C	Edmund Optics fixed focal lenth 16mm C-mount lens for 1" sensors (86-571)
LENS-160T6C	Tamron 16mm fixed focal length C-mount lens, for 1/1.2" and 2/3" sensors (M112FM16)
LENS-250T6C	Tamron 25mm fixed focal length C-mount lens, for 1/1.2" and 2/3" sensors (M112FM25)
LENS-160T7C	Tamron 16mm fixed focal length C-mount lens, for 1.1" sensors (M111FM16)
LENS-250C7C	Computar 25mm fixed focal length C-mount lens, for 1" sensors (V2528-MPY)
LENS-250T5C	Tamron fixed focal length 25mm C-mount lens for 2/3" sensors (23FM25SP)
LENS-250T7C	Tamron 25mm fixed focal length C-mount lens, for 1.1" sensors (M111FM25)

MONO CAMERA SENSOR REVIEW SORTED BY SENSOR TYPE (CMOS/CCD) AND RESOLUTION

	MODEL	SENSOR		SENSOR SIZE	INTERFACE	SENSOR TYPE	SHUTTER	MAX RESOLUTION	
CMOS	BFS-PGE-200S6M-C	SONY	IMX183	1"	POE GIGE	CMOS	ROLLING	5472	3648
	BFS-U3-200S6M-C	SONY	IMX183	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	5472	3648
	BFS-PGE-122S6M-C	SONY	IMX304	1.1"	POE GIGE	CMOS	GLOBAL	4096	3000
	BFS-U3-122S6M-C	SONY	IMX304	1.1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	3000
	BFS-U3-123S6M-C	SONY	IMX253	1.1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	3000
	GS3-U3-123S6M-C	SONY	IMX253	1.1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	3000
	ORX-10G-123S6M-C	SONY	IMX253	1.1"	10GIGE	CMOS	GLOBAL	4096	3000
	BFS-U3-120S4M-CS	SONY	IMX226	1/1.7"	USB 3.1 GEN. 1	CMOS	ROLLING	4000	3000
	BFS-PGE-88S6M-C	SONY	IMX267	1"	POE GIGE	CMOS	GLOBAL	4096	2160
	BFS-U3-88S6M-C	SONY	IMX267	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	2160
	BFS-U3-89S6M-C	SONY	IMX255	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	2160
	GS3-U3-89S6M-C	SONY	IMX255	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	4096	2160
	ORX-10G-89S6C-C	SONY	IMX255	1"	10GIGE	CMOS	GLOBAL	4096	2160
	BFS-PGE-70S7M-C	SONY	IMX428	1"	POE GIGE	CMOS	GLOBAL	3208	2200
	BFS-U3-70S7M-C	SONY	IMX428	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	3208	2200
	BFS-U3-63S4M-C	SONY	IMX178	1/1.8"	USB 3.1 GEN. 1	CMOS	ROLLING	3072	2048
	BFLY-PGE-50A2M-CS	APTINA	MT9P031	1/2.5"	POE GIGE	CMOS	ROLLING	2592	1944
	BFLY-PGE-50S5M-C	SONY	IMX264	2/3"	POE GIGE	CMOS	GLOBAL	2448	2048
	BFS-PGE-50S5M-C	SONY	IMX264	2/3"	POE GIGE	CMOS	GLOBAL	2448	2048
	BFS-PGE-51S5P-C	SONY	IMX250MZR	2/3"	POE GIGE	CMOS	GLOBAL	2448	2048
	BFS-U3-50S5M-C	SONY	IMX264	2/3"	USB 3.1 GEN. 1	CMOS	GLOBAL	2448	2048
	BFS-U3-51S5M-C	SONY	IMX250	2/3"	USB 3.1 GEN. 1	CMOS	GLOBAL	2448	2048
	BFS-U3-51S5P-C	SONY	IMX250MZR	2/3"	USB 3.1 GEN. 1	CMOS	GLOBAL	2448	2048
	CM3-U3-50S5M-CS	SONY	IMX264	2/3"	USB 3.1 GEN. 1	CMOS	GLOBAL	2448	2048
	GS3-U3-51S5M-C	SONY	IMX250	2/3"	USB 3.1 GEN. 1	CMOS	GLOBAL	2448	2048
	ORX-10G-51S5C-C	SONY	IMX250	2/3"	10GIGE	CMOS	GLOBAL	2448	2048
	BFLY-PGE-31S4M-C	SONY	IMX265	1/1.8"	POE GIGE	CMOS	GLOBAL	2048	1536
	BFS-PGE-31S4M-C	SONY	IMX265	1/1.8"	POE GIGE	CMOS	GLOBAL	2048	1536
	BFS-U3-31S4M-C	SONY	IMX265	1/1.8"	USB 3.1 GEN. 1	CMOS	GLOBAL	2048	1536
	BFS-U3-32S4M-C	SONY	IMX252	1/1.8"	USB 3.1 GEN. 1	CMOS	GLOBAL	2048	1536
	CM3-U3-31S4M-CS	SONY	IMX265	1/1.8"	USB 3.1 GEN. 1	CMOS	GLOBAL	2048	1536
	GS3-U3-41C6M-C	CMOSIS	CMV4000	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	2048	2048
	GS3-U3-41C6NIR-C	CMOSIS	CMV4000-NIR	1"	USB 3.1 GEN. 1	CMOS	GLOBAL	2048	2048
	GS3-U3-32S4M-C	SONY	IMX252	1/1.8"	USB 3.1 GEN. 1	CMOS	GLOBAL	2038	1536
	BFLY-PGE-23S6M-C	SONY	IMX249	1/1.2"	POE GIGE	CMOS	GLOBAL	1920	1200
	BFS-PGE-23S3M-C	SONY	IMX392	1/2.3"	POE GIGE	CMOS	GLOBAL	1920	1200
	BFS-U3-23S3M-C	SONY	IMX392	1/2.3"	USB 3.1 GEN. 1	CMOS	GLOBAL	1920	1200
	GS3-PGE-23S6M-C	SONY	IMX174	1/1.2"	POE GIGE	CMOS	GLOBAL	1920	1200
	GS3-U3-23S6M-C	SONY	IMX174	1/1.2"	USB 3.1 GEN. 1	CMOS	GLOBAL	1920	1200
	BFLY-PGE-20E4M-CS	E2V	EV76C570	1/1.8"	POE GIGE	CMOS	GLOBAL	1600	1200
	BFS-PGE-16S2M-CS	SONY	IMX273	1/2.9"	POE GIGE	CMOS	GLOBAL	1440	1080
	BFS-U3-16S2M-CS	SONY	IMX273	1/2.9"	USB 3.1 GEN. 1	CMOS	GLOBAL	1440	1080
	BFS-PGE-13Y3M-C	ON SEMI	PYTHON 1300	1/2"	POE GIGE	CMOS	GLOBAL	1280	1024
	BFS-U3-13Y3M-C	ON SEMI	PYTHON 1300	1/2"	USB 3.1 GEN. 1	CMOS	GLOBAL	1280	1024
	CM3-U3-13Y3M-CS	ON-SEMI	PYTHON1300	1/2"	USB 3.1 GEN. 1	CMOS	GLOBAL	1280	1024
	BFS-PGE-04S2M-CS	SONY	IMX287	1/2.9"	POE GIGE	CMOS	GLOBAL	720	540
	BFS-U3-04S2M-CS	SONY	IMX287	1/2.9"	USB 3.1 GEN. 1	CMOS	GLOBAL	720	540
CCD	BFLY-PGE-50H5M-C	SHARP	RJ32S4AA0DT	2/3"	POE GIGE	CCD	GLOBAL	2448	2048
	GS3-PGE-50S5M-C	SONY	ICX625	2/3"	POE GIGE	CCD	GLOBAL	2448	2048
	CM3-U3-28S4M-CS	SONY	ICX818	1/1.8"	USB 3.1 GEN. 1	CCD	GLOBAL	1928	1448
	GS3-U3-28S4M-C	SONY	ICX687	1/1.8"	USB 3.1 GEN. 1	CCD	GLOBAL	1928	1448
	GS3-U3-28S5M-C	SONY	ICX674	2/3"	USB 3.1 GEN. 1	CCD	GLOBAL	1920	1440
	BFLY-PGE-13H2M-CS	SHARP	RJ33J4CA3DE	1/3"	POE GIGE	CCD	GLOBAL	1288	964
	BFLY-U3-13S2M-CS	SONY	ICX445	1/3"	USB 3.1 GEN. 1	CCD	GLOBAL	1288	964
	BFLY-PGE-03S2M-CS	SONY	ICX424	1/3"	POE GIGE C	CD	GLOBAL	648	488
	BFLY-U3-03S2M-CS	SONY	ICX424	1/3"	USB 3.1 GEN. 1	CCD	GLOBAL	648	488

MEGA-PIXELS	MAX FPS	PIXEL SIZE (µm)	QE 525nm %	QE 850 nm %	QE 950nm %	TEMPORAL DARK NOISE	SNR MAX (dB)	SNR MAX BITS	ABSOLUTE SENSITIVITY THRESHOLD	SATURATION CAPACITY	DYNAMIC RANGE dB	DYNAMIC RANGE BITS	GAIN
20.0	6.1	2.4	77	18	8	3.32	41.75	6.93	3.82	14967	72.08	11.97	0.24
20.0	18	2.4	79	18	7	6.69	41.73	6.93	9.11	14889	66.32	11.02	0.24
12.3	10	3.45	72	19	6	2.43	40.4	6.17	4.12	10971	71.45	11.87	0.17
12.3	9.9	3.45	72	19	6	2.43	40.4	6.17	4.12	10971	71.45	11.87	0.17
12.3	30	3.45	71	16	5	2.3	40.15	6.67	5.06	10359	66.22	11	0.17
12.3	30	3.45	72	20	6	2.43	40.24	6.68	4.12	10563	71.04	11.8	0.17
12.3	68	3.45	71	16	5	2.3	20.15	6.67	5.06	10359	66.22	11	0.17
12.0	31	1.85	76	17	7	3.2	40.32	6.7	5.86	11344	65.28	10.84	0.17
8.9	13.9	3.45	71	20	6	2.41	40.41	6.71	4.13	10990	71.53	11.88	0.17
8.9	42	3.45	71	20	6	2.41	40.41	6.71	4.13	10990	71.53	11.88	0.17
8.9	32	3.45	71	20	6	2.43	40.19	6.67	4.13	10435	71.03	11.8	0.17
8.9	43	3.45	71	20	6	2.43	40.19	6.67	4.13	10435	71.03	11.8	0.17
8.9	93	3.45	71	20	6	2.43	40.19	6.67	4.13	10435	71.03	11.8	0.17
7.1	17	4.5	78	23	10	2.66	40.39	6.71	3.16	24778	71.75	11.92	0.39
7.1	51	4.5	78	23	10	2.66	40.39	6.71	3.16	24778	71.75	11.92	0.39
6.3	59.6	2.4	79	16	7	2.41	41.51	6.89	4.95	14158	71.4	11.09	0.23
5.0	13	2.2	63	14	5	7.64	38.26	6.35	13	6693	58.3	9.68	0.11
5.0	22	3.45	69	18	6	3.36	39.96	6.64	4.1	9909	70.78	11.76	0.17
5.0	22	3.45	69	18	6	3.36	39.96	6.64	4.1	9909	70.78	11.76	0.17
5.0	24	3.45	18	6	2	3.26	40.11	6.66	3.76	10259	68.71	11.41	0.16
5.0	35	3.45	69	18	6	3.36	39.96	6.64	4.1	9909	70.78	11.76	0.17
5.0	75	3.45	76	19	6	2.37	40.15	6.67	4.03	10361	71.15	11.82	0.17
5.0	75	3.45	18	6	2	3.26	40.11	6.66	3.76	10259	68.71	11.41	0.16
5.0	35	3.45	69	18	6	2.29	39.94	6.63	4.03	9869	70.97	11.79	0.17
5.0	75	3.45	76	19	6	2.37	40.15	6.67	4.03	10361	71.15	11.82	0.17
5.0	163	3.45	76	19	6	2.37	40.15	6.67	4.03	10361	71.15	11.82	0.17
3.1	35	3.45	72	19	6	2.31	40.14	6.67	3.93	10326	71.31	11.84	0.17
3.1	35	3.45	72	19	6	2.31	40.14	6.67	3.93	10326	71.31	11.84	0.17
3.1	57	3.45	72	19	6	2.31	40.14	6.67	3.93	10326	71.31	11.84	0.17
3.1	118	3.45	76	19	6	2.34	40.2	6.68	3.98	10482	71.34	11.85	0.17
3.1	55	3.45	71	19	7	2.89	39.9	6.63	4.8	9777	69.19	11.49	0.17
4.2	90	5.5	53	18	7	16.81	38.82	6.45	33.38	7620	52.87	8.78	0.15
4.2	90	5.5	57	32	13	17.99	39.59	6.58	31.01	9094	53.84	8.94	0.15
3.1	121	3.45	76	19	6	2.34	40.2	6.68	3.98	10482	71.34	11.85	0.17
2.3	41	5.86	80	15	5	7.11	45.19	7.5	9.45	33105	72.77	12.08	0.52
2.3	49	3.45	62	15	5	2.31	40.3	6.69	2.81	10725	71.63	11.9	0.17
2.3	164	3.45	62	15	5	2.31	40.3	6.69	2.81	10725	71.63	11.9	0.17
2.3	46	5.86	77	14	4	6.83	45.14	7.5	9.75	32691	72.99	12.12	0.51
2.3	162	5.86	76	13	4	6.83	45.12	7.49	9.77	32513	72.94	12.11	0.52
1.9	50	4.5	48	15	6	21.28	38.94	6.47	42.26	7836	51.12	8.49	0.13
1.6	73	3.45	71	17	5	2.46	40.28	6.69	8.59	10662	65.78	10.93	0.17
1.6	241	3.45	71	17	5	2.46	40.28	6.69	8.59	10662	65.78	10.93	0.17
1.3	84	4.8	59	20	8	9.28	37.82	6.28	16.14	6057	55.84	9.28	0.15
1.3	170	4.8	59	20	8	9.28	37.82	6.28	16.14	6057	55.84	9.28	0.15
1.3	149	4.8	59	20	8	9.28	37.82	6.28	16.14	6057	55.84	9.28	0.15
0.4	295	6.9	71	17	6	10.3	43.26	7.19	16.93	21178	65.8	10.94	0.35
0.4	523	6.9	71	17	6	10.3	43.26	7.19	16.93	21178	65.8	10.94	0.35
5.0	7.5	3.45	57	8	2	5.48	39.08	6.49	10.67	8086	62.61	10.4	0.13
5.0	15	3.45	57	8	3	8.18	37.71	6.26	15.69	5903	56.66	9.41	0.1
2.8	13	3.69	76	16	5	10.48	40.39	6.71	14.67	10936	59.96	9.96	0.18
2.8	26	3.69	68	15	5	10.17	39.56	6.57	15.78	9039	58.56	9.73	0.15
2.8	26	4.54	67	17	5	9.39	41.67	6.92	14.86	14693	63.43	10.54	0.24
1.2	30	3.75	70	17	5	5.37	38.68	6.43	8.55	7384	61.99	10.3	0.12
1.2	30	3.75	62	16	5	10.3	39.86	6.62	17.78	9686	59.06	9.81	0.15
0.3	84	7.4	46	7	2	12.86	41.44	6.88	29.74	13932	60.37	10.03	0.22
0.3	84	7.4	53	8	3	12.03	41.37	6.87	24.76	13701	60.78	10.1	0.22

*Mode 7 (Low Noise Imaging Mode)

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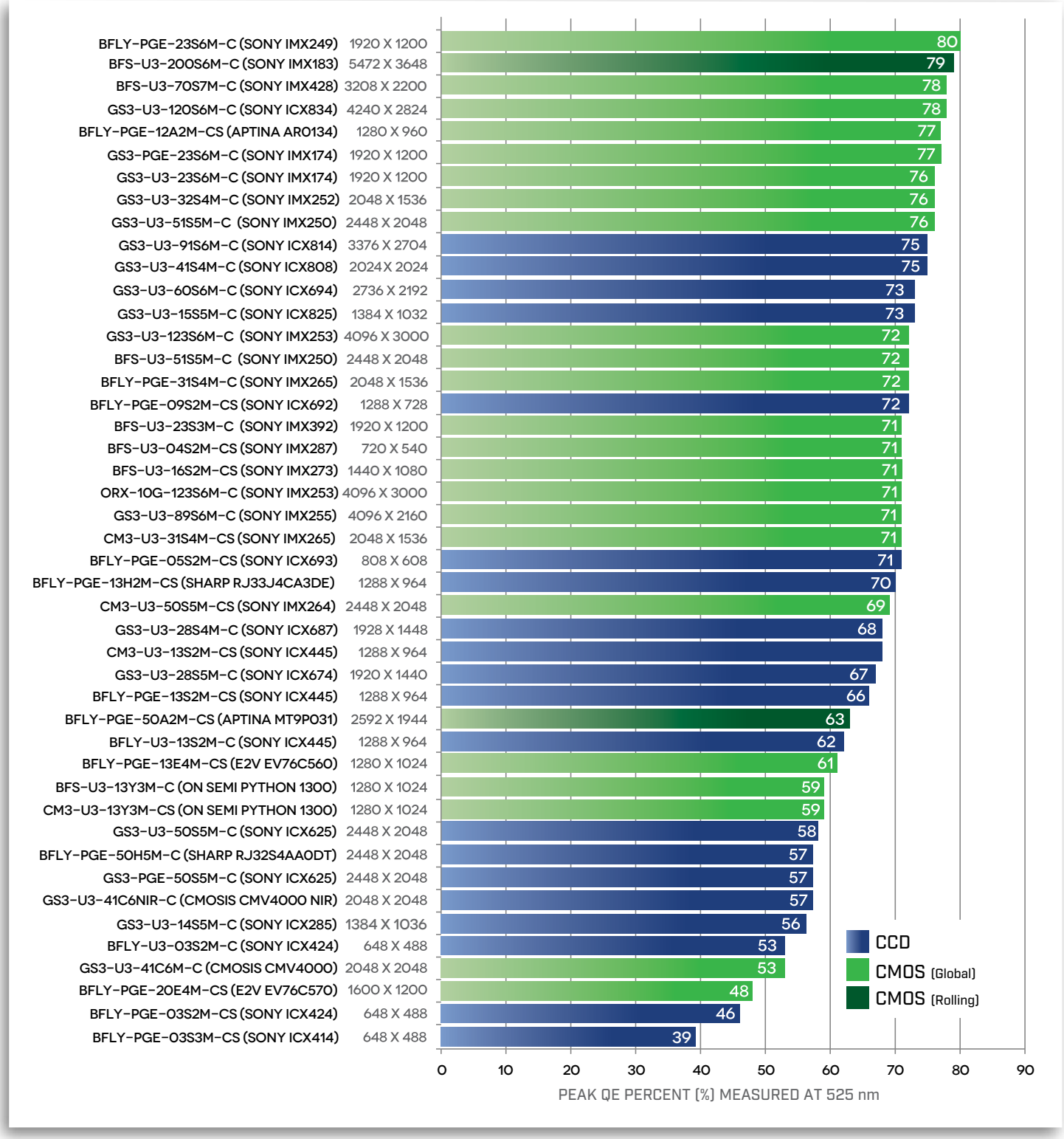
MONO SINGLE LENS CAMERAS

QUANTUM EFFICIENCY (%) AT 525 nm (HIGHER IS BETTER)

Quantum efficiency (QE) is the ability of the sensor to turn photons into electrons, or in other words, turn incoming light into an electrical signal for imaging. A higher QE % means greater sensitivity for detecting light. A sensor with a measurement of 79% means that for every 100 photons that hit the sensor an average of 79 will be detected. Please note that the results below are taken at the wavelength of 525nm.

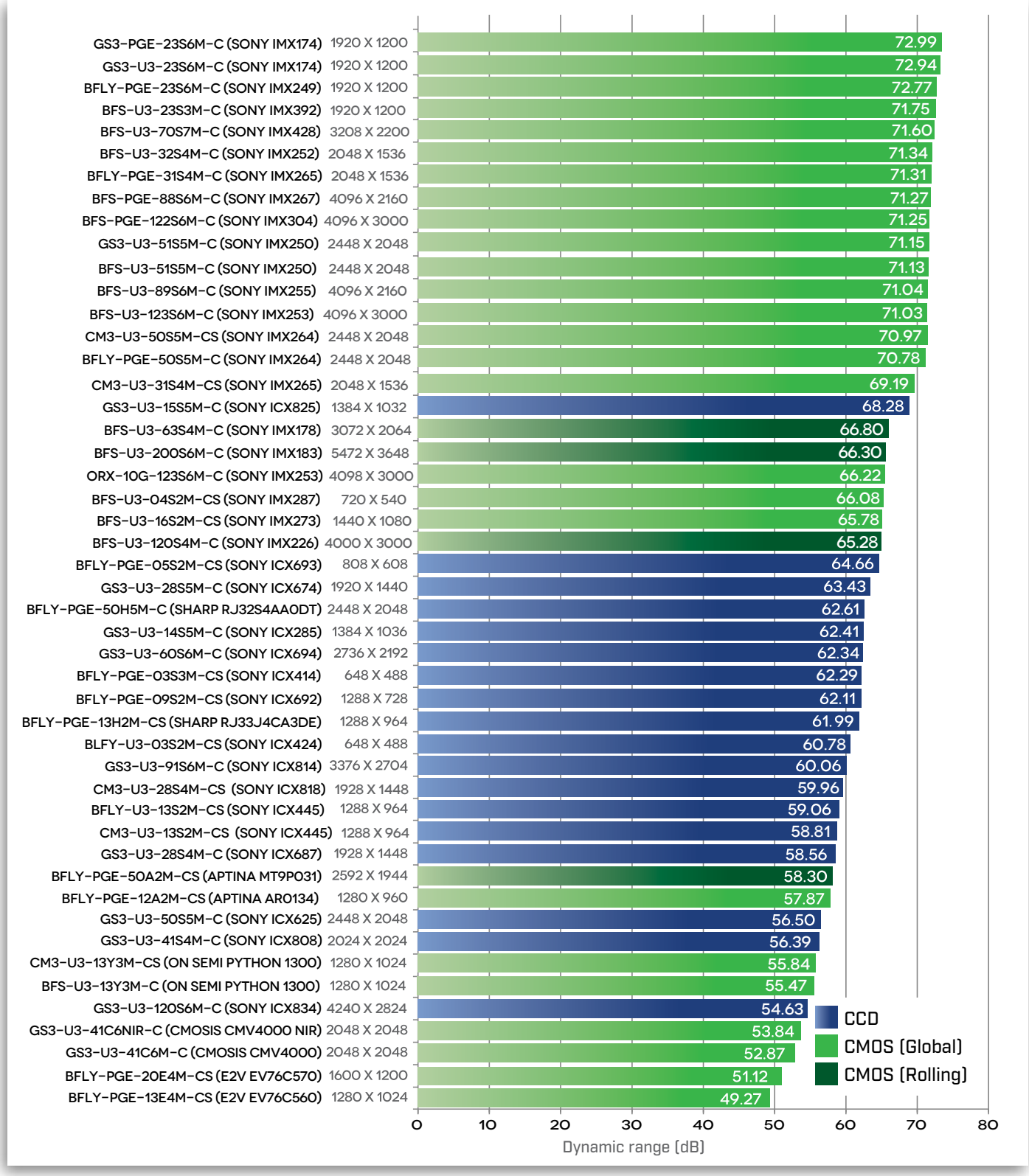


Please note that all measurements are taken based on guidelines in the EMVA 1288 standard. Camera settings are at maximum exposure time and bit depth unless otherwise noted. The pixel format is Mono 16 for mono cameras except for the last two Bandwidth and Throughput graphs which are done at Mono 8. Results are captured at room temperature (20°C). For more information on the EMVA 1288 standard please visit EMVA.org. Thanks for considering FLIR and please enjoy our mono camera sensor review.

MONO SINGLE LENS CAMERAS

DYNAMIC RANGE dB (HIGHER IS BETTER)

Dynamic range describes the camera model's ability to detect the maximum and minimum of light intensities (shadows and highlights). Models with higher dynamic range can detect more detail in the darks and lights.



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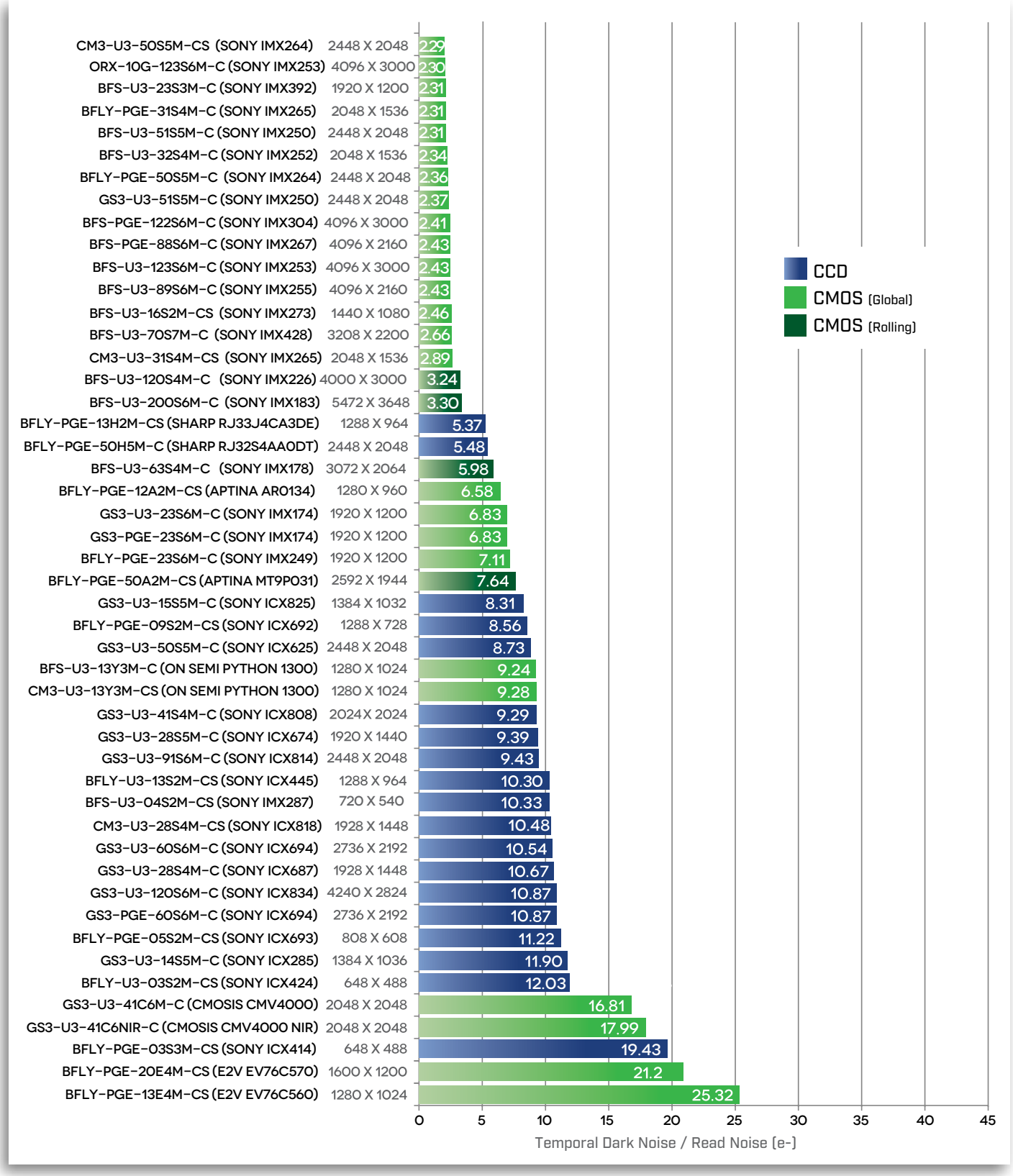
MONO SINGLE LENS CAMERAS

TEMPORAL DARK NOISE / READ NOISE e- (LOWER IS BETTER)

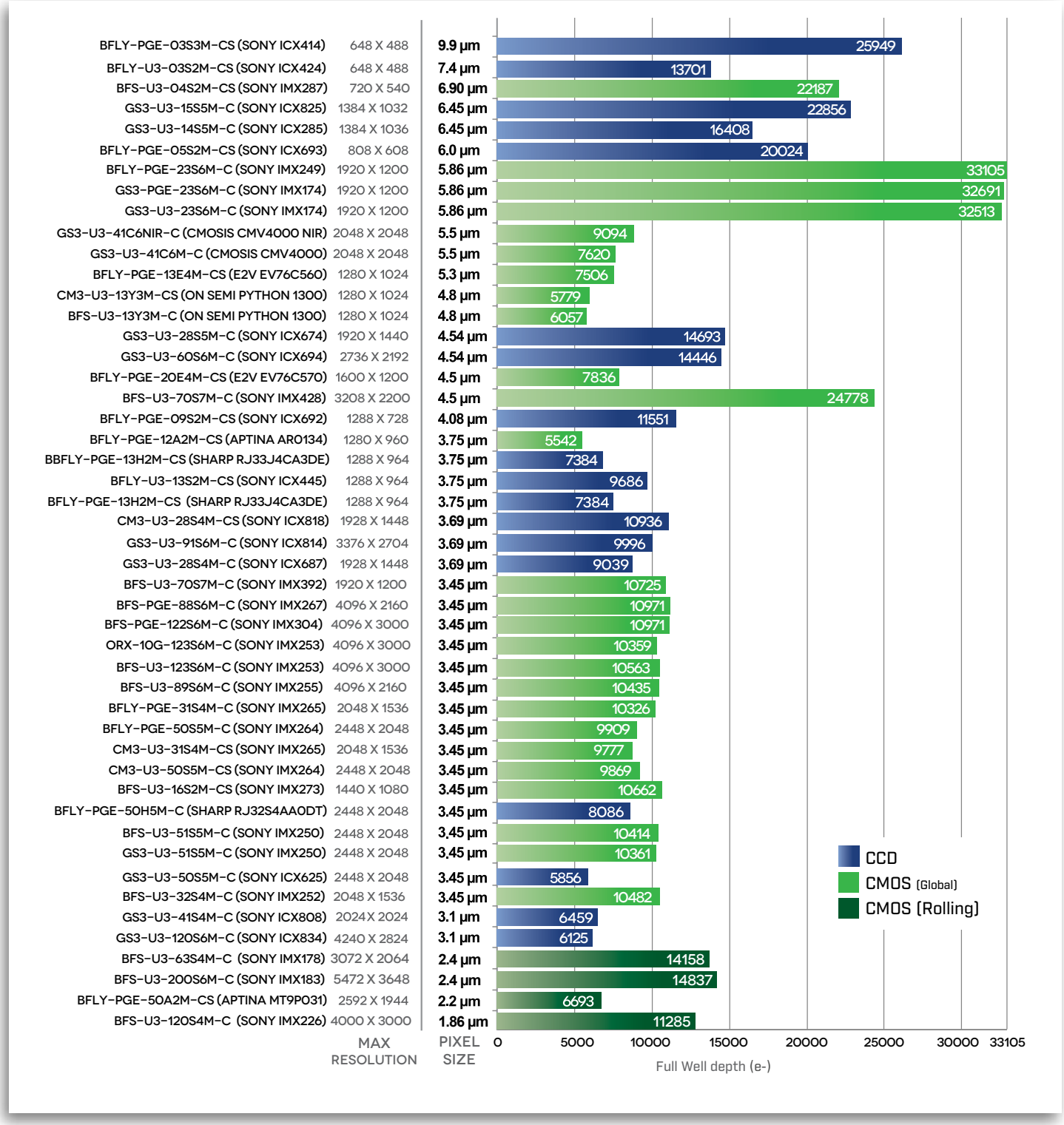
Temporal dark noise (also known as read noise) comes from energy within the sensor and the surrounding sensor electronics. Over time, random electrons are created that fall into the sensor wells and are detected and turned into signal. Models with lower read noise measurements produce cleaner images.



MONO SINGLE LENS CAMERAS

SATURATION CAPACITY (WELL DEPTH) e- (HIGHER IS BETTER, SORTED BY PIXEL SIZE)

The saturation capacity (well depth) is the largest charge a pixel can hold before over-saturation occurs and signal degradation begins. Saturation must be avoided because it diminishes the quantitative ability of the sensor and in the case of CCDs produces image smearing due to a phenomenon known as blooming.



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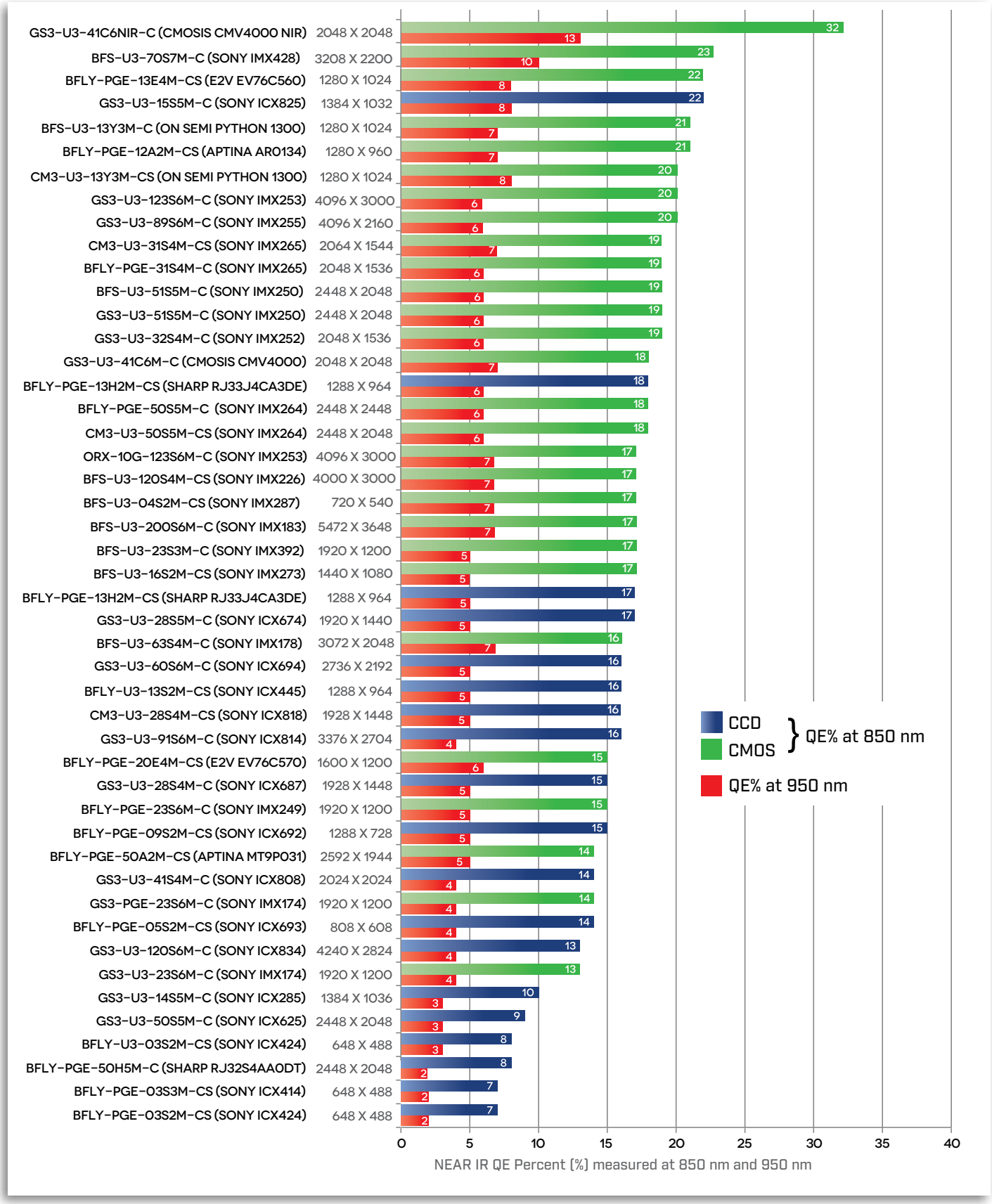
MONO SINGLE LENS CAMERAS

NEAR IR QE (%) (HIGHER IS BETTER)



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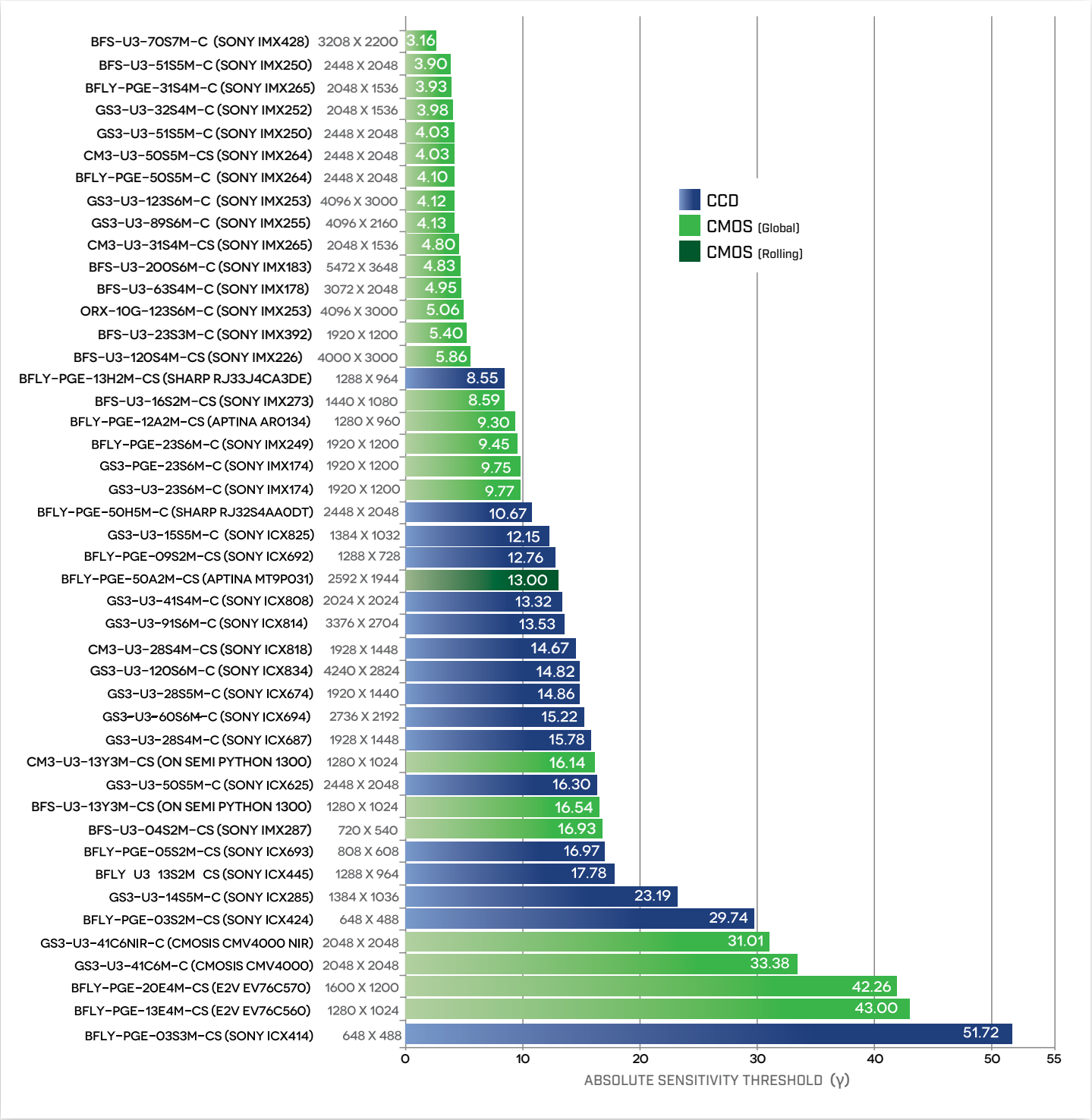
MONO SINGLE LENS CAMERAS

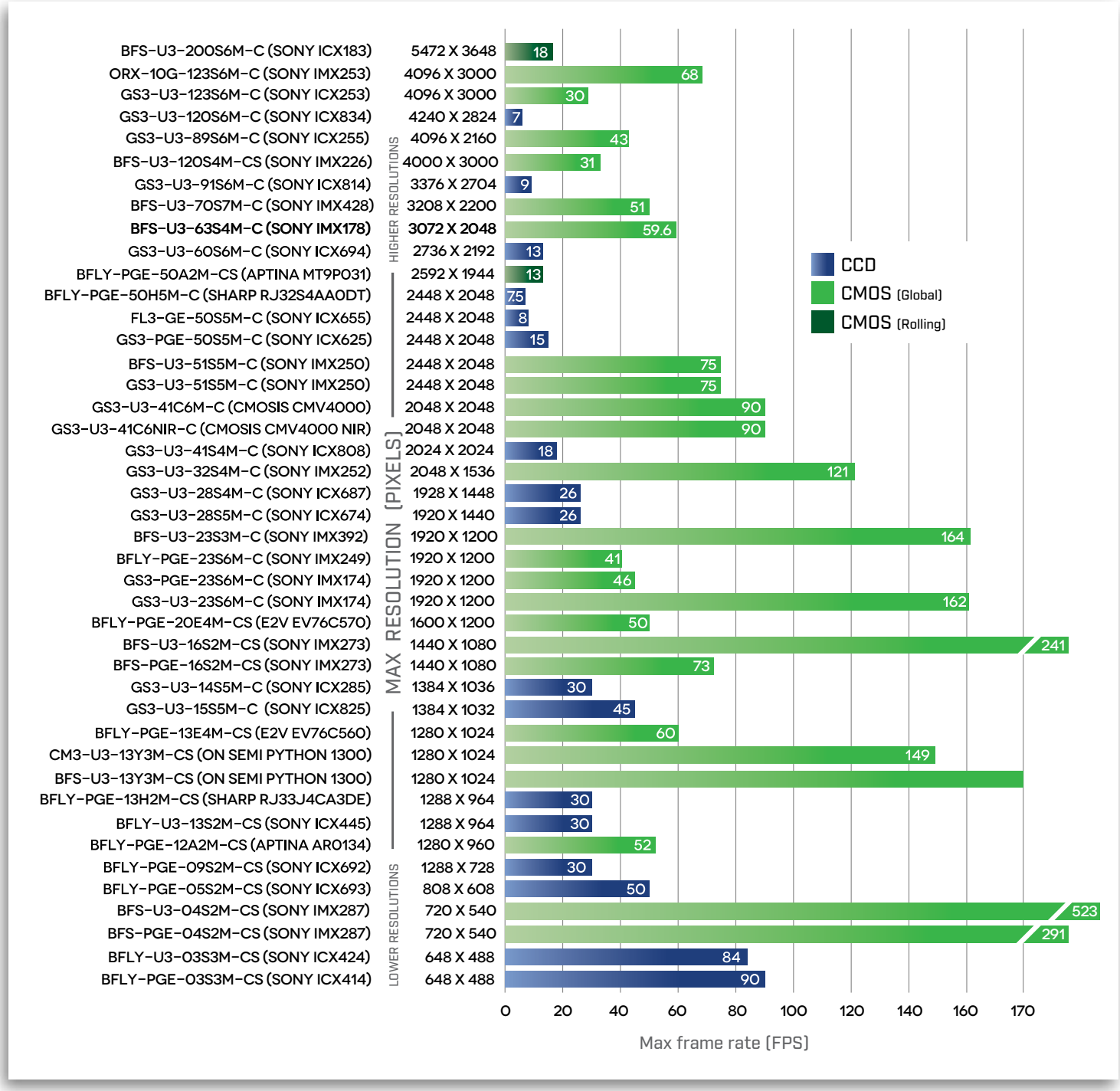
ABSOLUTE SENSITIVITY THRESHOLD (γ) (LESS IS BETTER)

Absolute sensitivity threshold is the minimum number of photons needed to equal the noise level.
The lower the number the less light is needed to detect useful imaging data.



MONO SINGLE LENS CAMERAS

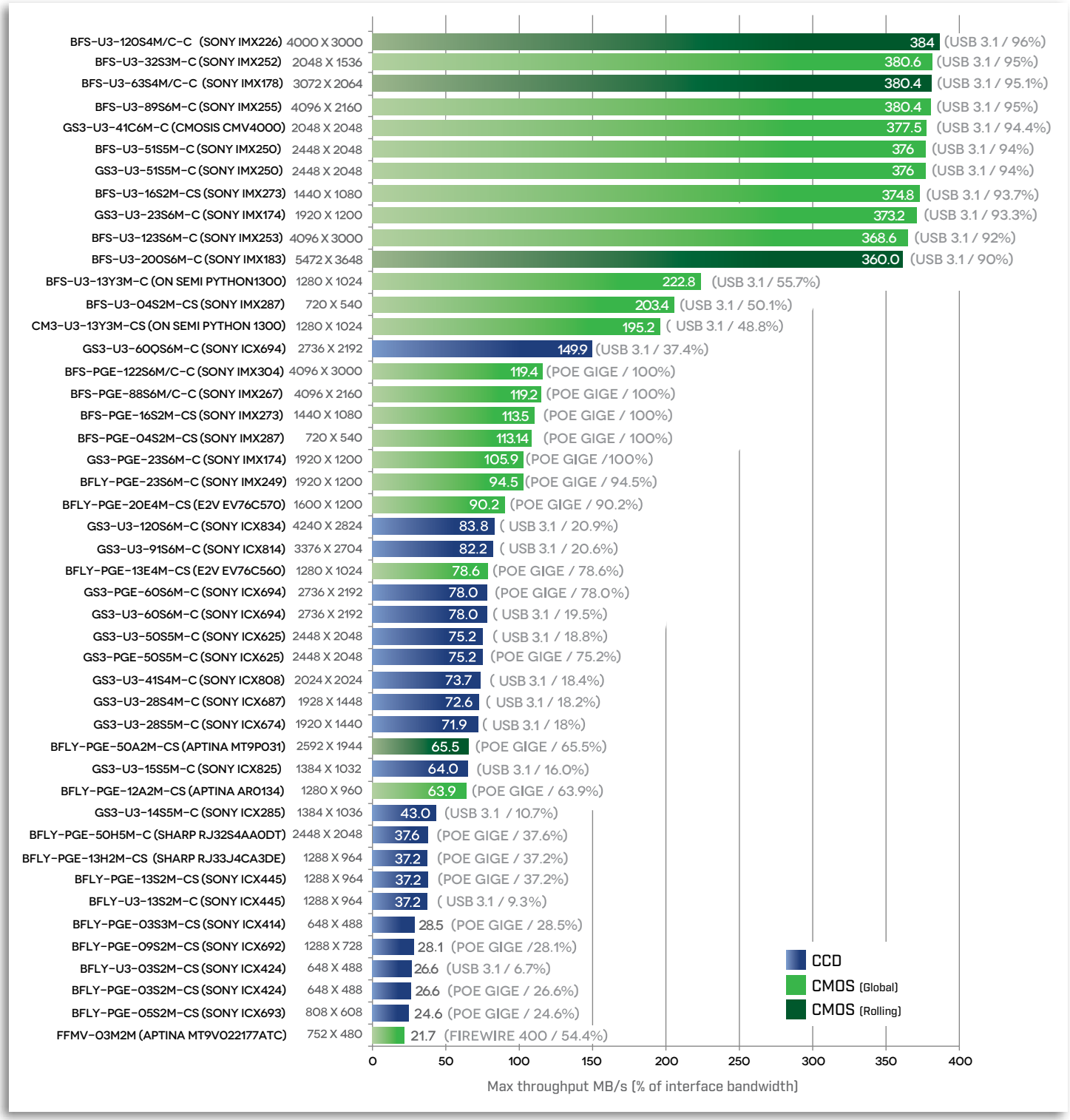
MAX RESOLUTION TO MAX FRAME RATE



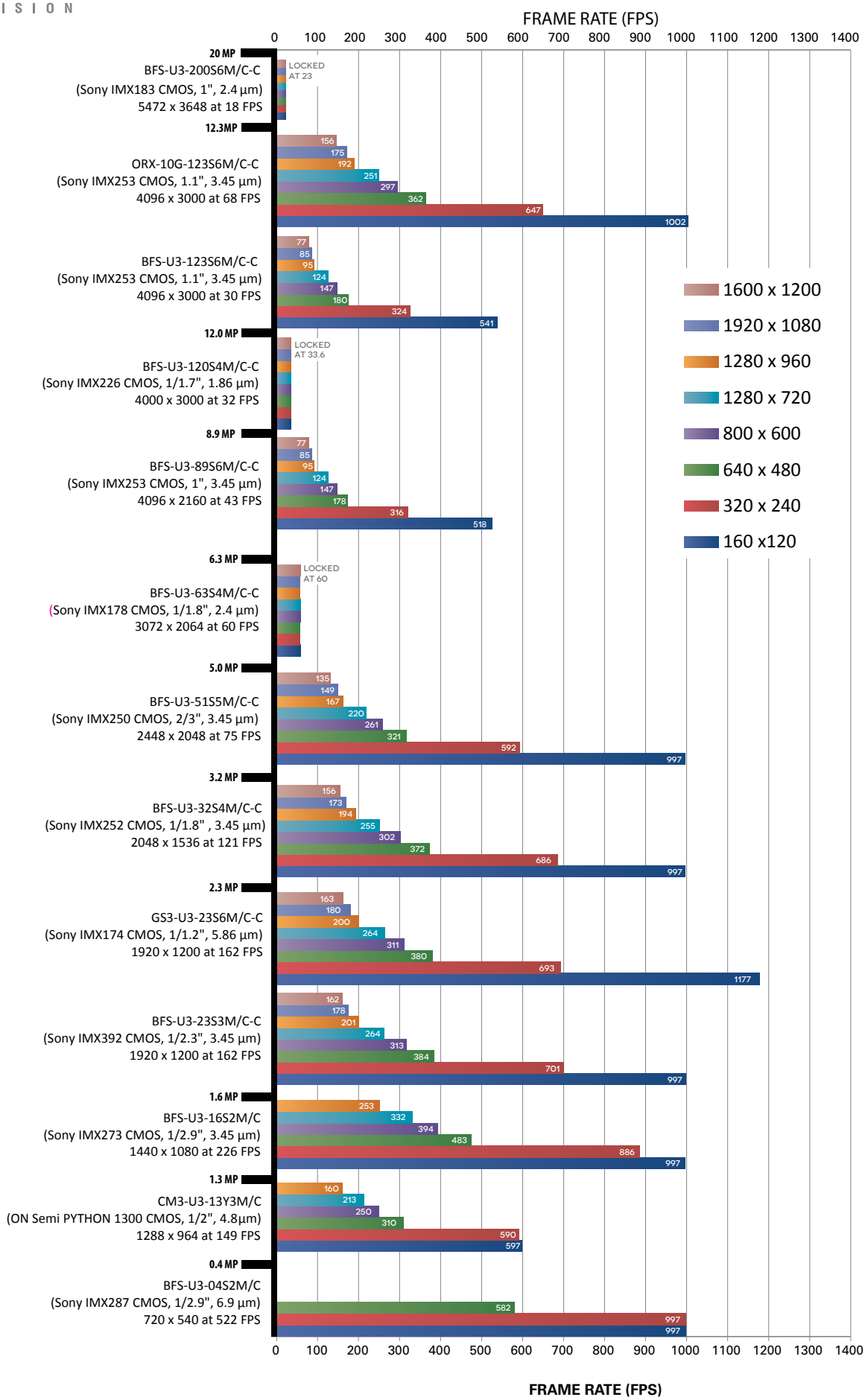
MONO SINGLE LENS CAMERAS

CAMERA THROUGHPUT (MB/s) AND % OF INTERFACE BANDWIDTH

When considering multi-camera setups bandwidth considerations are a must. We calculated the maximum throughput (MB/s) by multiplying the maximum resolution by the maximum frame rate (note: to simplify these calculations an image data format of Mono8 was used). In addition we added the percentage of interface bandwidth which the camera model pumped out. For those calculations we used 400 MB/s for USB 3.1 Gen 1, 100 MB/s for GigE, 80 MB/s for FireWire 800, and 40 MB/s for both FireWire 400 and USB 2.0.



USB 3.1 Gen 1 CMOS Resolution vs Frame Rate Chart



Note: Depending on your camera firmware and system setup your frame rates might differ. Frame rate results from Raw8 or Mono8 pixel format.

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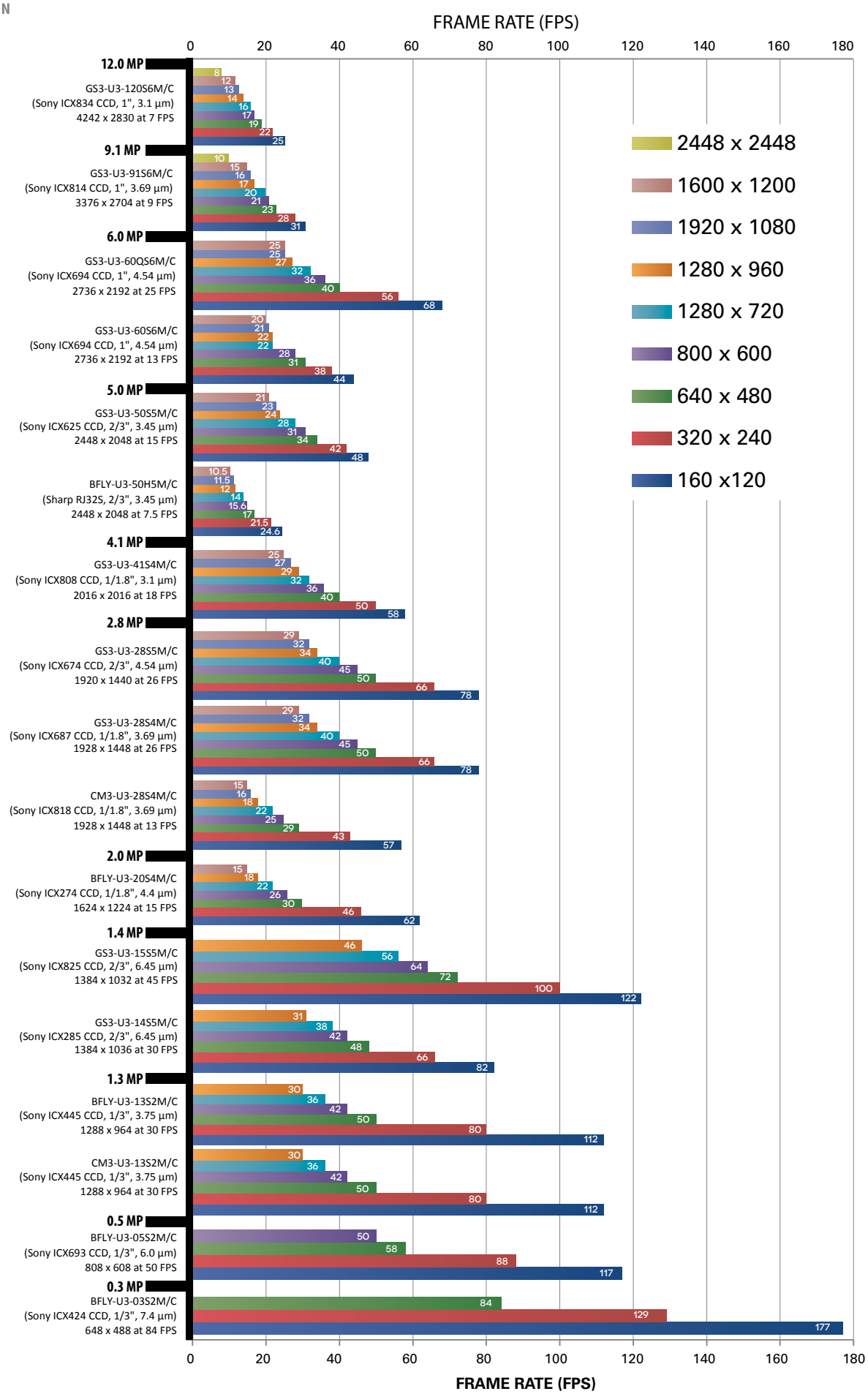
USB 3.1 Gen 1 CCD Resolution vs Frame Rate Chart



Note: Depending on your camera firmware and system setup your frame rates might differ. Frame rate results from Raw8 or Mono8 pixel format.

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