Blackfly PGE

PoE Digital Camera

Imaging Performance Specification

Version 11.0

Revised 1/22/2015

Point Grey Research® Inc.

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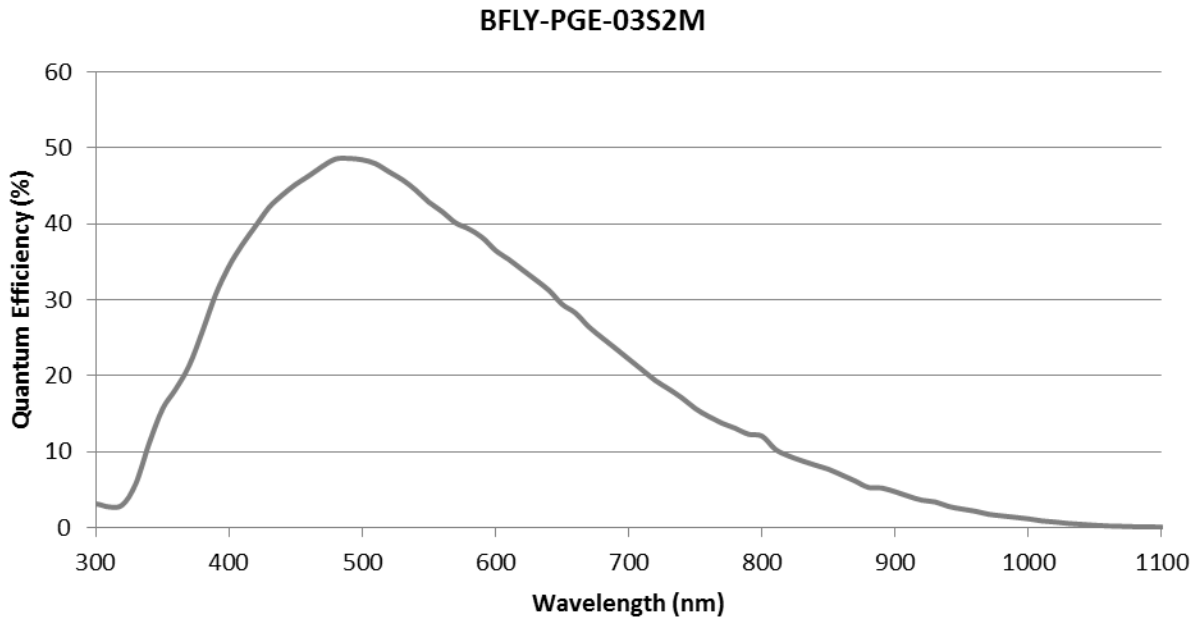
1 Specifications

Model	Sensor	Maximum Resolution	Pixel Size	Firmware	Results
BFLY-PGE-03S2M-CS	Sony ICX424, 1/3", Mono	648 x 488	7.4 µm	1.30.3.0	page 3
BFLY-PGE-03S2C-CS	Sony ICX424, 1/3", Color	648 x 488	7.4 µm	1.30.3.0	page 4
BFLY-PGE-03S3M-CS	Sony ICX414, 1/2", Mono	648 x 648	9.9 µm	1.35.3.0	page 5
BFLY-PGE-03S3C-CS	Sony ICX414, 1/2", Color	648 x 648	9.9 µm	1.35.3.0	page 6
BFLY-PGE-05S2M-CS	Sony ICX693, 1/3", Mono	808 x 608	6.0 µm	1.32.3.0	page 7
BFLY-PGE-05S2C-CS	Sony ICX693, 1/3", Color	808 x 608	6.0 µm	1.32.3.0	page 8
BFLY-PGE-09S2M-CS	Sony ICX692, 1/3", Mono	1288 x 728	4.08 µm	1.14.3.0	page 9
BFLY-PGE-09S2C-CS	Sony ICX692, 1/3", Color	1288 x 728	4.08 µm	1.12.3.0	page 10
BFLY-PGE-12A2M-CS	Aptina AR0134, 1/3", Mono	1280 x 960	3.75 µm	1.27.3.0	page 11
BFLY-PGE-12A2C-CS	Aptina AR0134, 1/3", Color	1280 x 960	3.75 µm	1.27.3.0	page 12
BFLY-PGE-13E4M-CS	e2v EV76C560, 1/1.8", Mono	1280 x 1024	5.3 µm	1.26.3.0	page 13
BFLY-PGE-13E4C-CS	e2v EV76C560, 1/1.8", Color	1280 x 1024	5.3 µm	1.26.3.0	page 14
BFLY-PGE-13S2M-CS	Sony ICX445, 1/3", Mono	1288 x 964	3.75 µm	1.22.3.0	page 15
BFLY-PGE-13S2C-CS	Sony ICX445, 1/3", Color	1288 x 964	3.75 µm	1.22.3.0	page 16
BFLY-PGE-14S2C-CS	Sony IMX104, 1/3", Color	1296 x 1032	3.75 µm	1.21.3.0	page 17
BFLY-PGE-20E4M-CS	e2v EV76C570, 1/1.8", Mono	1600 x 1200	4.5 µm	1.43.3.0	page 18
BFLY-PGE-20E4C-CS	e2v EV76C570, 1/1.8", Color	1600 x 1200	4.5 µm	1.43.3.0	page 19
BFLY-PGE-23S2C-CS	Sony IMX136, 1/2.8", Color	1920 x 1200	2.8 µm	1.17.3.0	page 20
BFLY-PGE-23S6M-C	Sony IMX249, 1/1.2", Mono	1920 x 1200	5.86 µm	1.40.3.0	page 21
BFLY-PGE-23S6C-C	Sony IMX249, 1/1.2", Color	1920 x 1200	5.86 µm	1.40.3.0	page 22
BFLY-PGE-50A2M-CS	Aptina MT9P031, 1/2.5", Mono	2592 x 1944	2.2 µm	1.27.3.0	page 23
BFLY-PGE-50A2C-CS	Aptina MT9P006, 1/2.5", Color	2592 x 1944	2.2 µm	1.27.3.0	page 24
BFLY-PGE-50H5M-C	Sharp RJ32S4AA0DT, 2/3", Mono	2448 x 2048	3.45 µm	1.42.3.0	page 25
BFLY-PGE-50H5C-C	Sharp RJ32S3AA0DT, 2/3", Color	2448 x 2048	3.45 µm	1.42.3.0	page 26

Measurements are taken based on guidelines in the EMVA 1288 standard; the full definition can be found at EMVA.org. Camera settings are at maximum exposure time and bit depth unless otherwise noted. The pixel format is Mono 16 for mono cameras and Raw 16 for color cameras. Results are captured at room temperature (20°C).

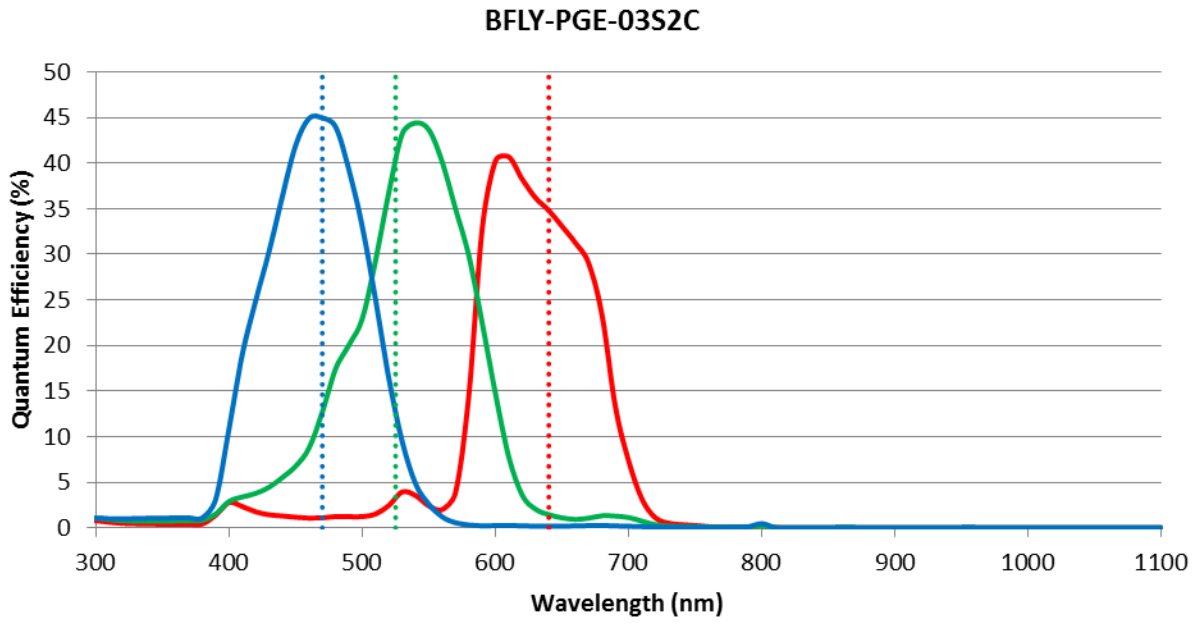
2 BFLY-PGE-03S2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	84 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	46
Temporal Dark Noise (Read Noise) (e-)	12.86
Signal to Noise Ratio Maximum (dB)	41.44
Signal to Noise Ratio Maximum (Bits)	6.88
Absolute Sensitivity Threshold (γ)	29.74
Saturation Capacity (Well Depth) (e-)	13932
Dynamic Range (dB)	60.37
Dynamic Range (Bits)	10.03
Gain (e-/ADU)	0.22



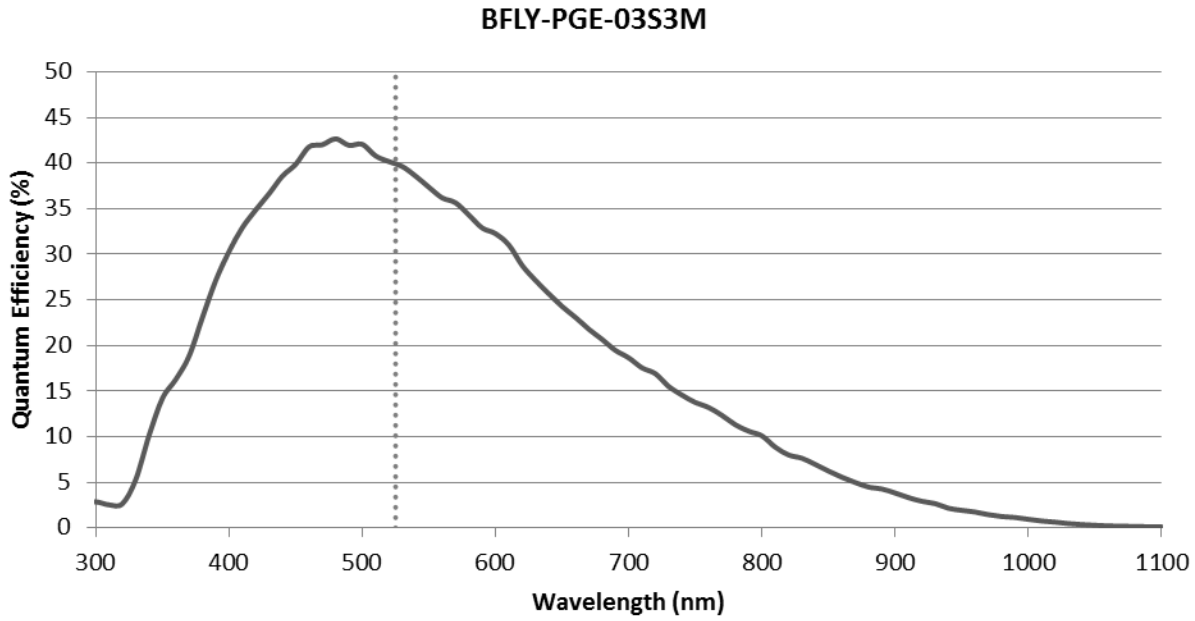
3 BFLY-PGE-03S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	84 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	44
Quantum Efficiency Green (% at 525 nm)	40
Quantum Efficiency Red (% at 640 nm)	34
Temporal Dark Noise (Read Noise) (e-)	13.87
Signal to Noise Ratio Maximum (dB)	41.91
Signal to Noise Ratio Maximum (Bits)	6.96
Absolute Sensitivity Threshold (γ)	37.66
Saturation Capacity (Well Depth) (e-)	15506
Dynamic Range (dB)	60.66
Dynamic Range (Bits)	10.08
Gain (e-/ADU)	0.24



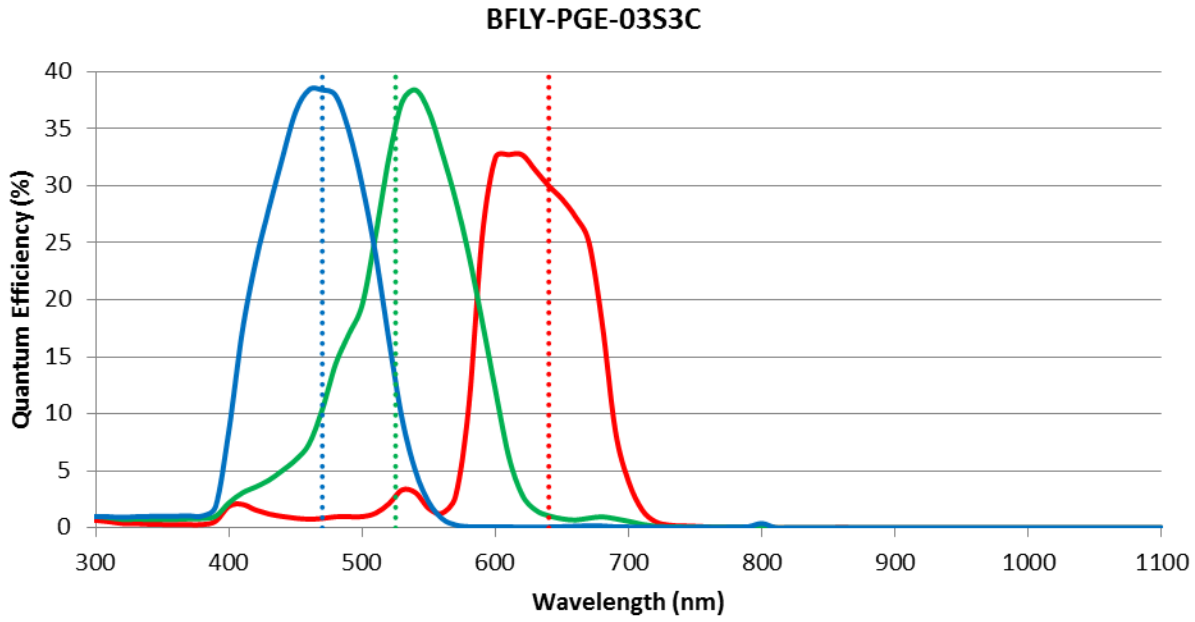
4 BFLY-PGE-03S3M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	90 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	39
Temporal Dark Noise (Read Noise) (e-)	19.43
Signal to Noise Ratio Maximum (dB)	44.14
Signal to Noise Ratio Maximum (Bits)	7.33
Absolute Sensitivity Threshold (γ)	51.72
Saturation Capacity (Well Depth) (e-)	25949
Dynamic Range (dB)	62.29
Dynamic Range (Bits)	10.35
Gain (e-/ADU)	0.41



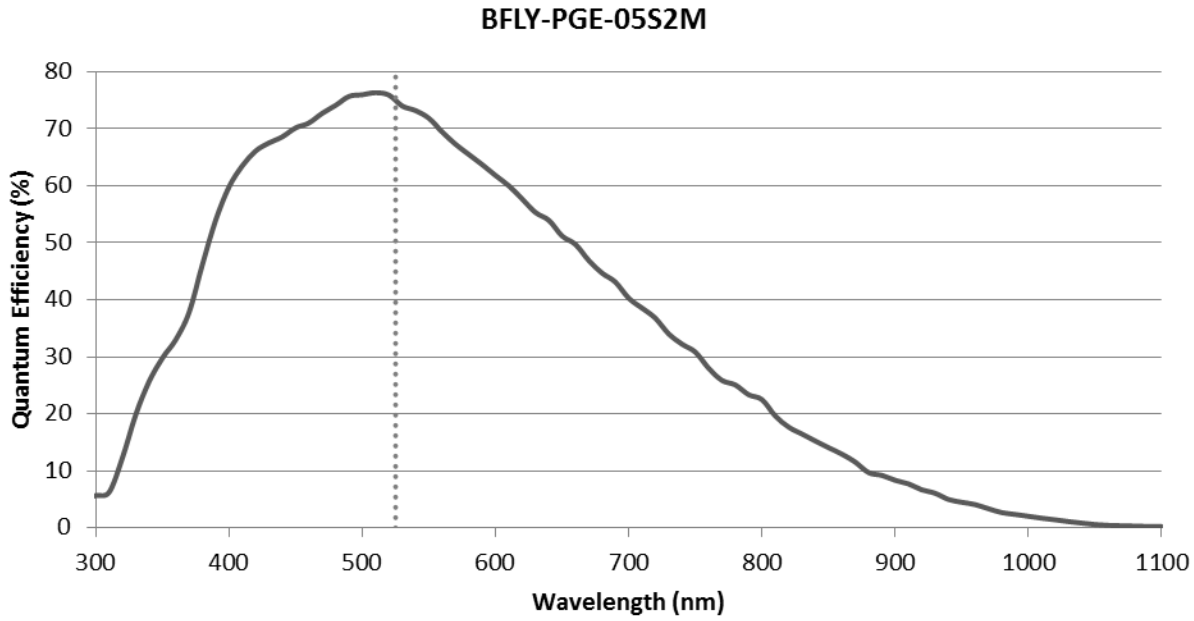
5 BFLY-PGE-03S3C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	90 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	38
Quantum Efficiency Green (% at 525 nm)	34
Quantum Efficiency Red (% at 640 nm)	29
Temporal Dark Noise (Read Noise) (e-)	19.64
Signal to Noise Ratio Maximum (dB)	44.27
Signal to Noise Ratio Maximum (Bits)	7.35
Absolute Sensitivity Threshold (γ)	60.15
Saturation Capacity (Well Depth) (e-)	26750
Dynamic Range (dB)	62.46
Dynamic Range (Bits)	10.37
Gain (e-/ADU)	0.43



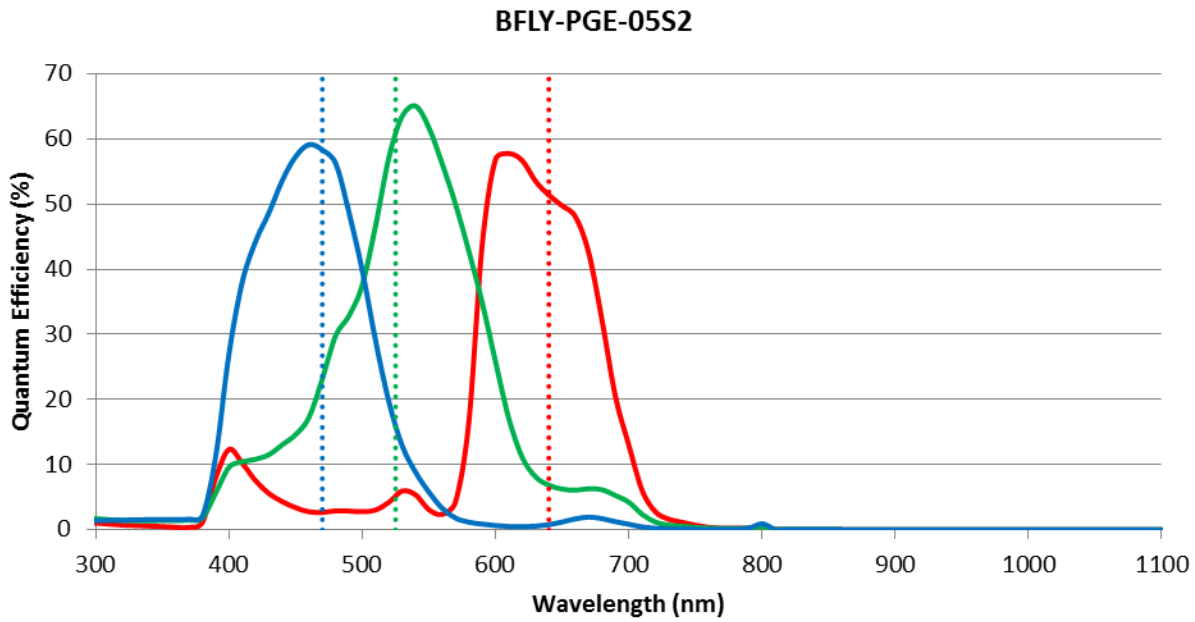
6 BFLY-PGE-05S2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	50 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	74
Temporal Dark Noise (Read Noise) (e-)	9.10
Signal to Noise Ratio Maximum (dB)	43.59
Signal to Noise Ratio Maximum (Bits)	7.24
Absolute Sensitivity Threshold (γ)	13.19
Saturation Capacity (Well Depth) (e-)	22843
Dynamic Range (dB)	67.53
Dynamic Range (Bits)	11.22
Gain (e-/ADU)	0.37



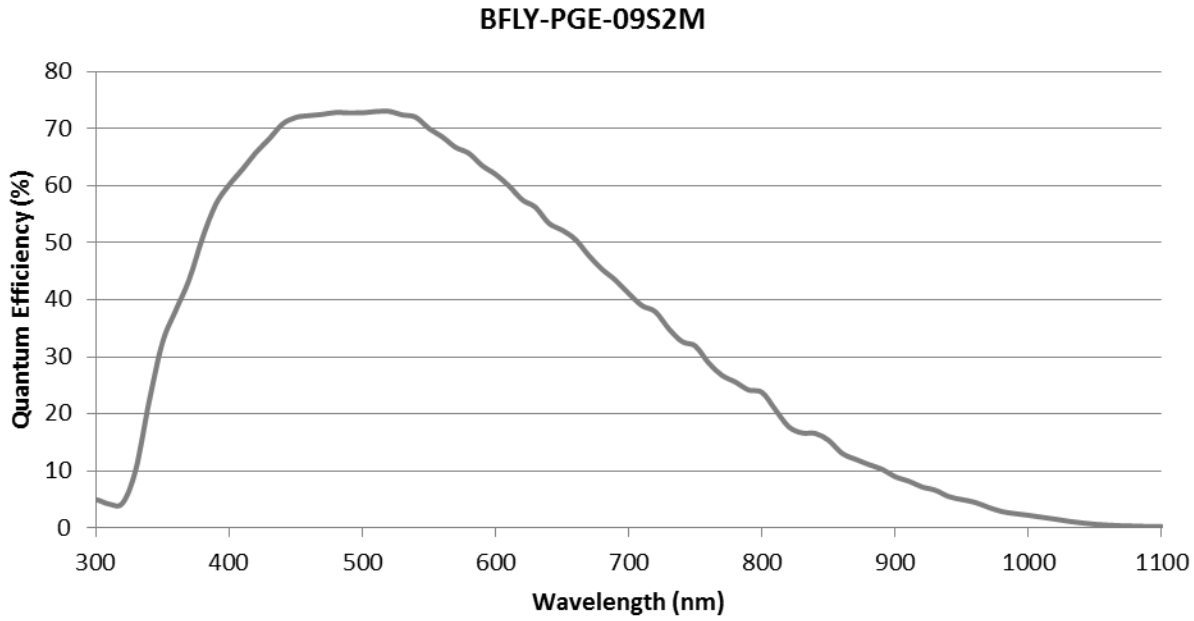
7 BFLY-PGE-05S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	50 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	58
Quantum Efficiency Green (% at 525 nm)	60
Quantum Efficiency Red (% at 640 nm)	51
Temporal Dark Noise (Read Noise) (e-)	9.04
Signal to Noise Ratio Maximum (dB)	43.23
Signal to Noise Ratio Maximum (Bits)	7.18
Absolute Sensitivity Threshold (γ)	16.58
Saturation Capacity (Well Depth) (e-)	21047
Dynamic Range (dB)	66.87
Dynamic Range (Bits)	11.11
Gain (e-/ADU)	0.037



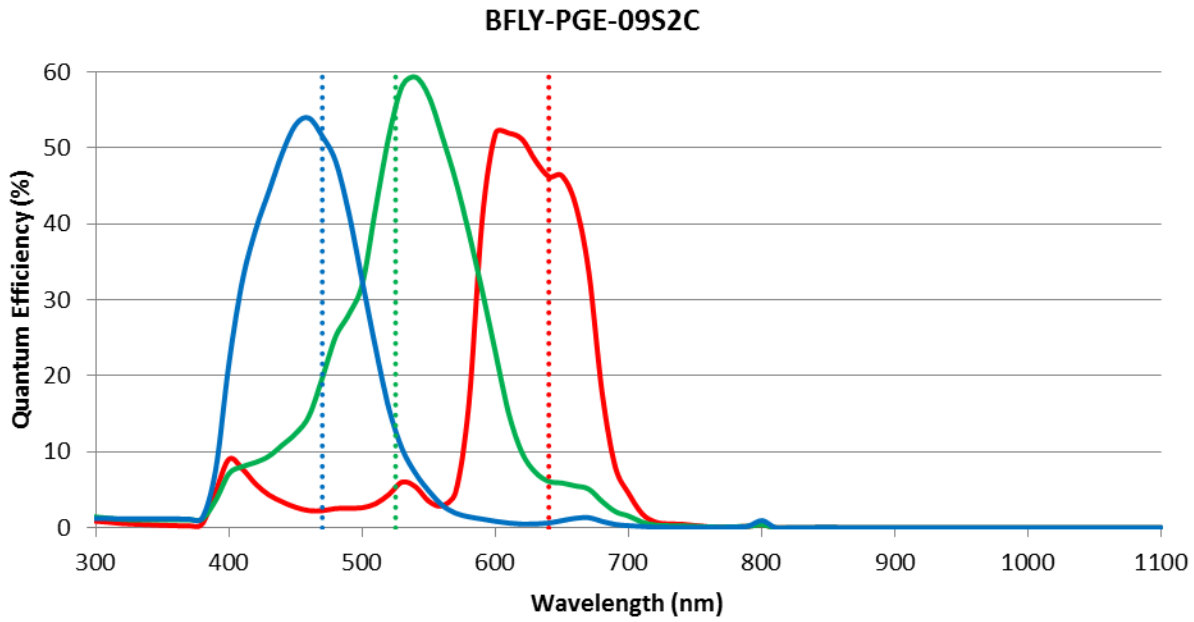
8 BFLY-PGE-09S2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	30 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	72
Temporal Dark Noise (Read Noise) (e-)	8.28
Signal to Noise Ratio Maximum (dB)	40.70
Signal to Noise Ratio Maximum (Bits)	6.76
Absolute Sensitivity Threshold (γ)	12.38
Saturation Capacity (Well Depth) (e-)	11747
Dynamic Range (dB)	62.53
Dynamic Range (Bits)	10.39
Gain (e-/ADU)	0.21



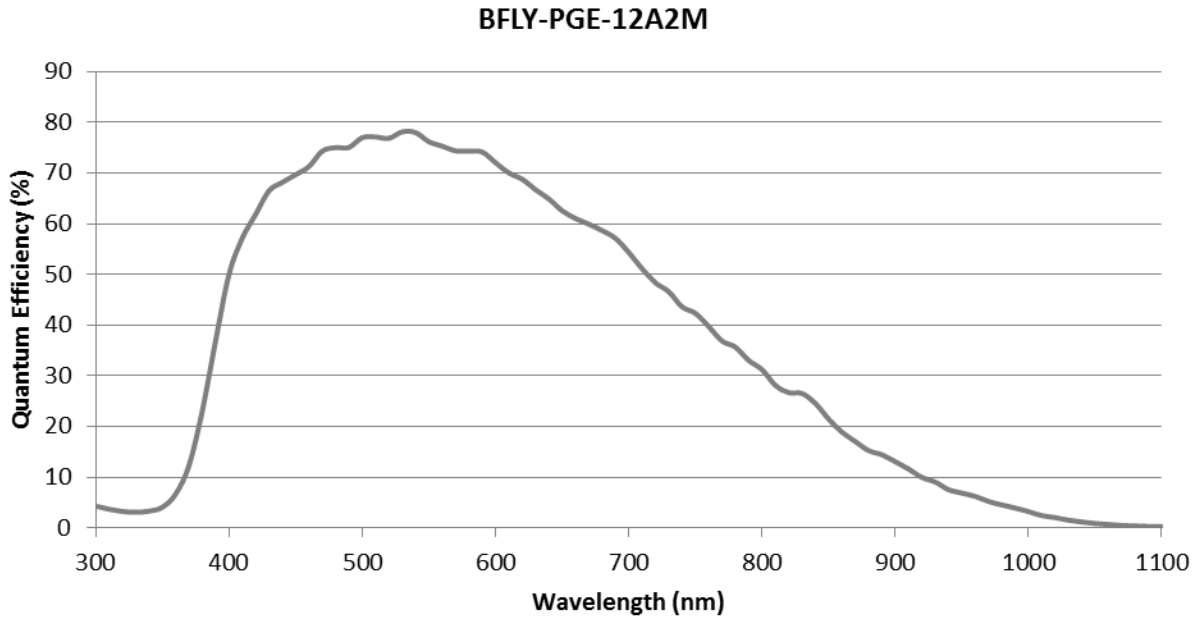
9 BFLY-PGE-09S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	30 FPS
Pixel Clock (MHz)	36
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	51
Quantum Efficiency Green (% at 525 nm)	54
Quantum Efficiency Red (% at 640 nm)	46
Temporal Dark Noise (Read Noise) (e-)	8.82
Signal to Noise Ratio Maximum (dB)	40.45
Signal to Noise Ratio Maximum (Bits)	6.72
Absolute Sensitivity Threshold (γ)	18.07
Saturation Capacity (Well Depth) (e-)	11078
Dynamic Range (dB)	61.51
Dynamic Range (Bits)	10.22
Gain (e-/ADU)	0.24



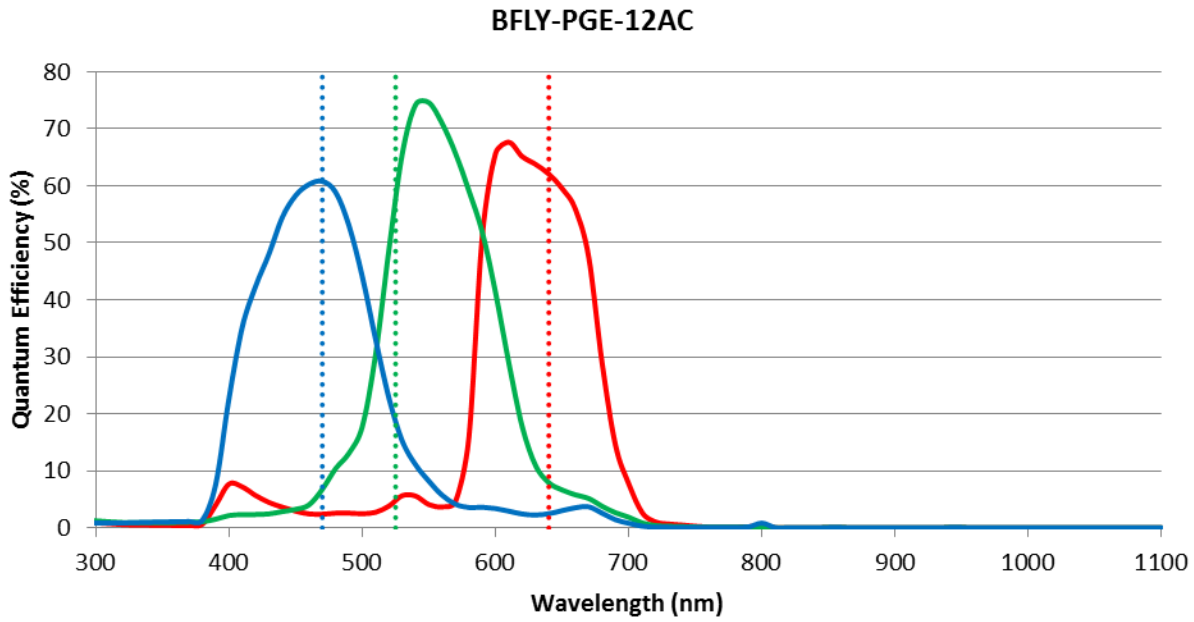
10 BFLY-PGE-12A2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	52 FPS
Pixel Clock (MHz)	74.25
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	77
Temporal Dark Noise (Read Noise) (e-)	6.58
Signal to Noise Ratio Maximum (dB)	37.44
Signal to Noise Ratio Maximum (Bits)	6.22
Absolute Sensitivity Threshold (γ)	9.30
Saturation Capacity (Well Depth) (e-)	5542
Dynamic Range (dB)	57.87
Dynamic Range (Bits)	9.61
Gain (e-/ADU)	0.10



11 BFLY-PGE-12A2C-CS Imaging Performance

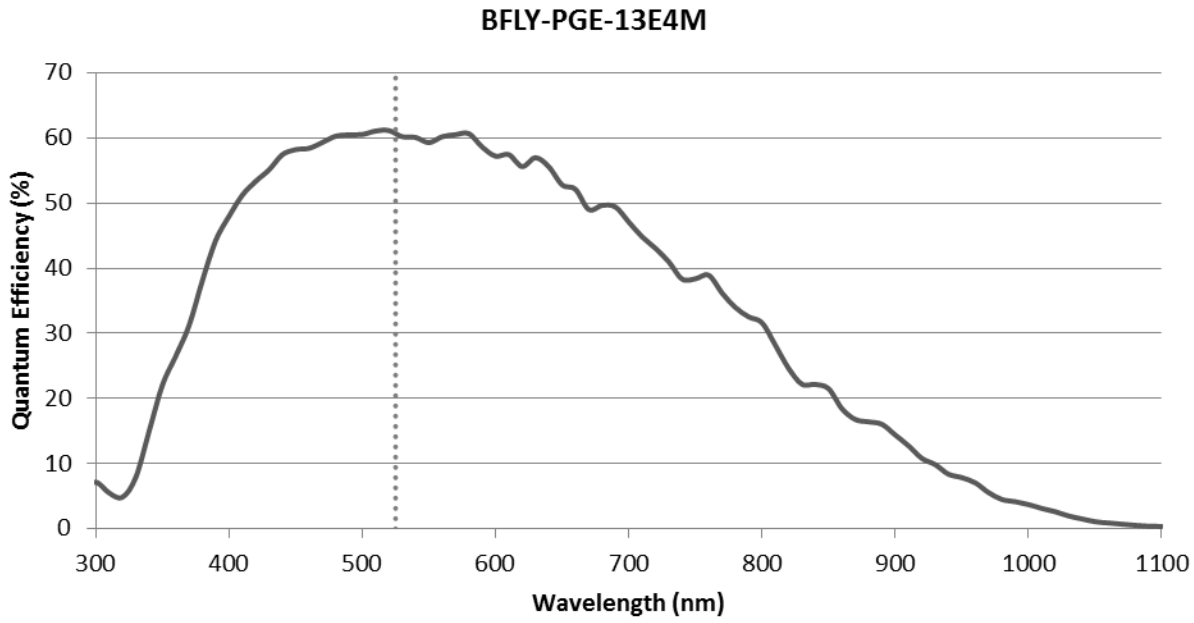
Measurement	Video Mode 0
Frame Rate (FPS)	52 FPS
Pixel Clock (MHz)	74.25
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	60
Quantum Efficiency Green (% at 525 nm)	57
Quantum Efficiency Red (% at 640 nm)	62
Temporal Dark Noise (Read Noise) (e-)	5.12
Signal to Noise Ratio Maximum (dB)	37.49
Signal to Noise Ratio Maximum (Bits)	6.23
Absolute Sensitivity Threshold (γ)	9.73
Saturation Capacity (Well Depth) (e-)	5608
Dynamic Range (dB)	59.97
Dynamic Range (Bits)	9.96
Gain (e-/ADU)	0.10



12 BFLY-PGE-13E4M-CS Imaging Performance

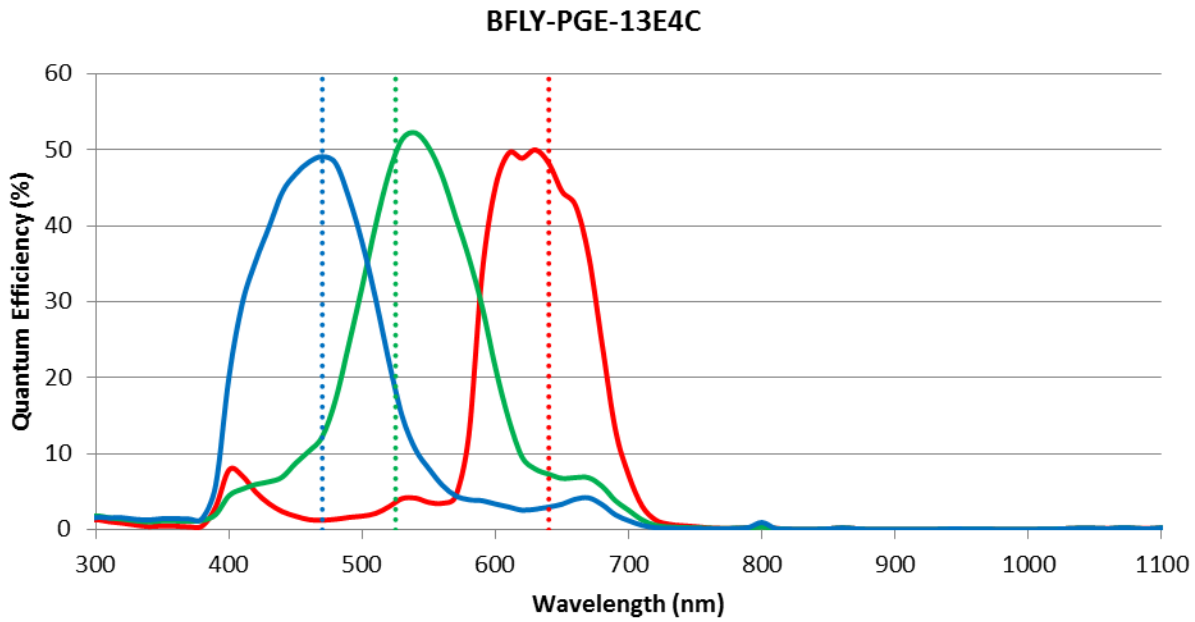
Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	60 FPS	60 FPS
Pixel Clock (MHz)	114	114
ADC (Bits)	10-bit	10-bit
Quantum Efficiency (% at 525 nm)	60	60
Temporal Dark Noise (Read Noise) (e-)	24.57	9.16
Signal to Noise Ratio Maximum (dB)	39.84	39.95
Signal to Noise Ratio Maximum (Bits)	6.62	6.64
Absolute Sensitivity Threshold (γ)	41.87	16.03
Saturation Capacity (Well Depth) (e-)	9632	9893
Dynamic Range (dB)	51.69	60.21
Dynamic Range (Bits)	8.59	10.00
Gain (e-/ADU)	0.16	0.16

Measurements taken at 30 ms maximum exposure.



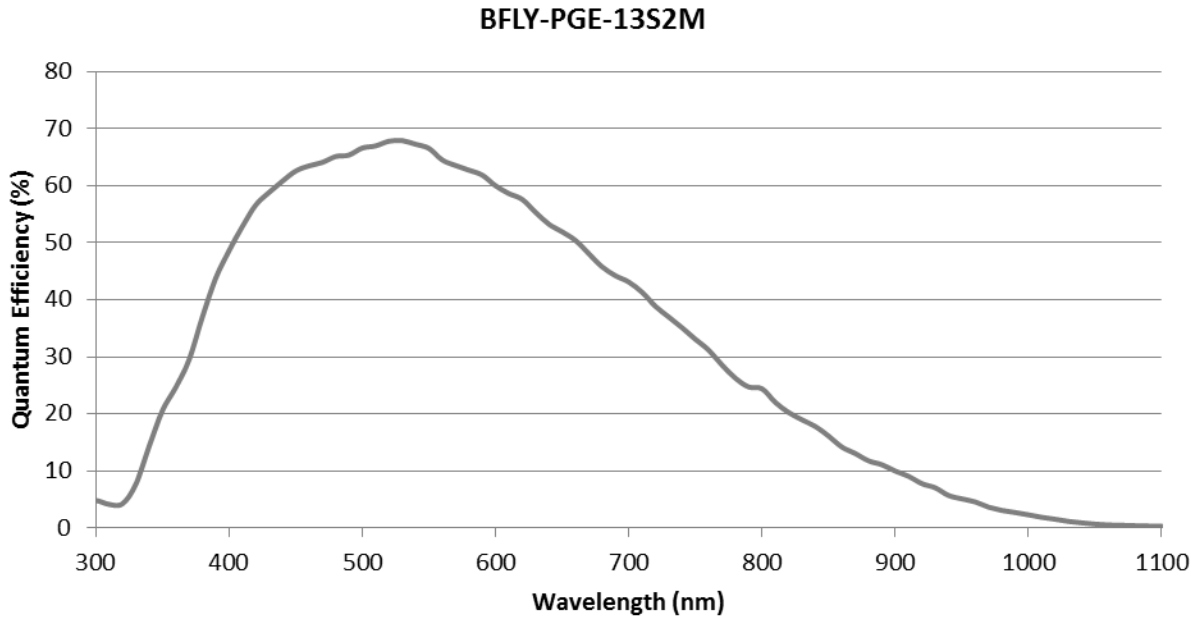
13 BFLY-PGE-13E4C-CS Imaging Performance

Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	60 FPS	60 FPS
Pixel Clock (MHz)	114	114
ADC (Bits)	10-bit	10-bit
Quantum Efficiency Blue (% at 470 nm)	49	48
Quantum Efficiency Green (% at 525 nm)	49	48
Quantum Efficiency Red (% at 640 nm)	48	47
Temporal Dark Noise (Read Noise) (e-)	25.03	9.31
Signal to Noise Ratio Maximum (dB)	39.48	39.66
Signal to Noise Ratio Maximum (Bits)	6.56	6.59
Absolute Sensitivity Threshold (γ)	55.06	21.25
Saturation Capacity (Well Depth) (e-)	8875	9245
Dynamic Range (dB)	50.82	59.48
Dynamic Range (Bits)	8.44	9.88
Gain (e-/ADU)	0.16	0.16



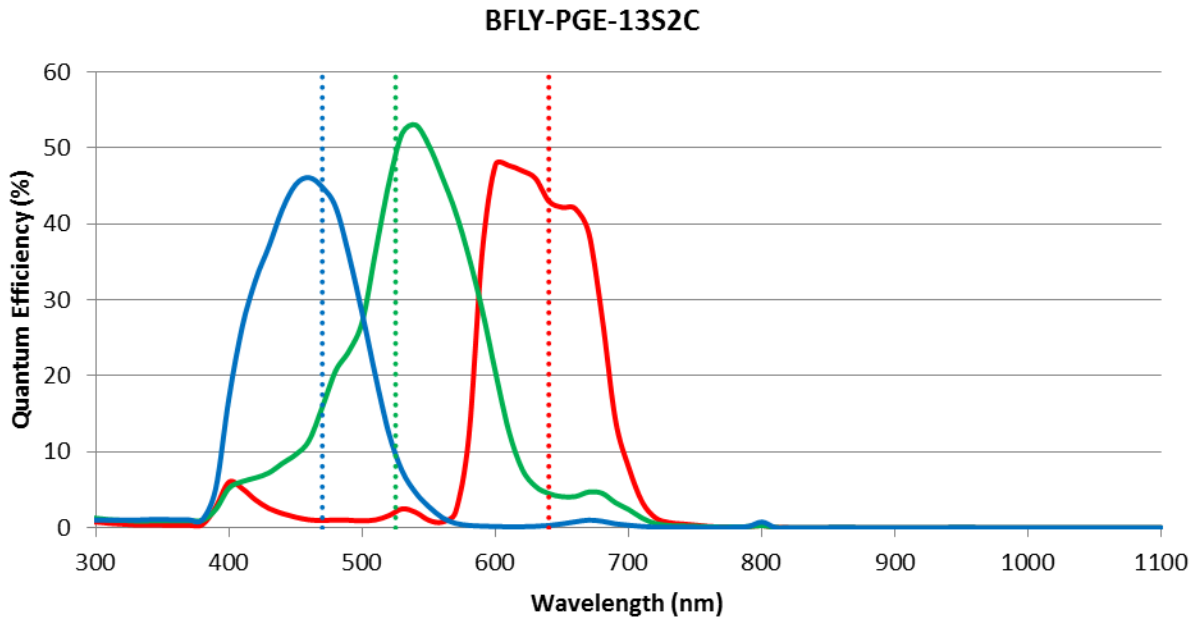
14 BFLY-PGE-13S2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	22 FPS
Pixel Clock (MHz)	36
ADC (Bits)	10-bit
Quantum Efficiency (% at 525 nm)	66
Temporal Dark Noise (Read Noise) (e-)	9.23
Signal to Noise Ratio Maximum (dB)	39.64
Signal to Noise Ratio Maximum (Bits)	6.58
Absolute Sensitivity Threshold (γ)	15.00
Saturation Capacity (Well Depth) (e-)	9196
Dynamic Range (dB)	59.51
Dynamic Range (Bits)	9.88
Gain (e-/ADU)	0.15



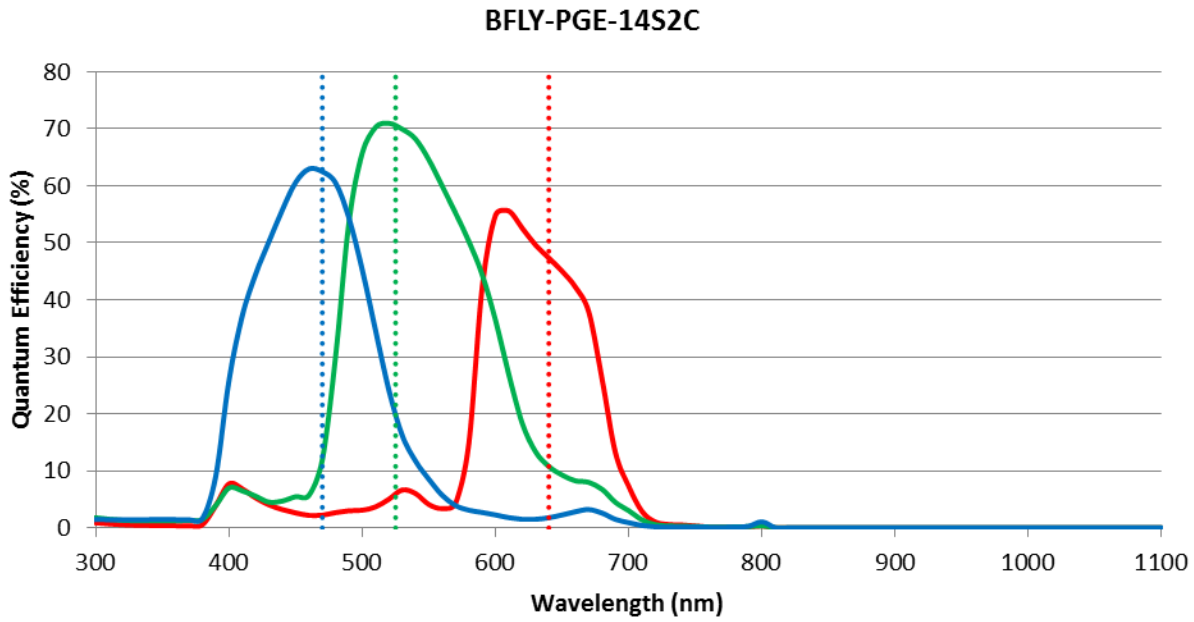
15 BFLY-PGE-13S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	22 FPS
Pixel Clock (MHz)	36
ADC (Bits)	10-bit
Quantum Efficiency Blue (% at 470 nm)	44
Quantum Efficiency Green (% at 525 nm)	48
Quantum Efficiency Red (% at 640 nm)	43
Temporal Dark Noise (Read Noise) (e-)	8.57
Signal to Noise Ratio Maximum (dB)	39.41
Signal to Noise Ratio Maximum (Bits)	6.55
Absolute Sensitivity Threshold (γ)	19.87
Saturation Capacity (Well Depth) (e-)	8720
Dynamic Range (dB)	59.66
Dynamic Range (Bits)	9.91
Gain (e-/ADU)	0.14



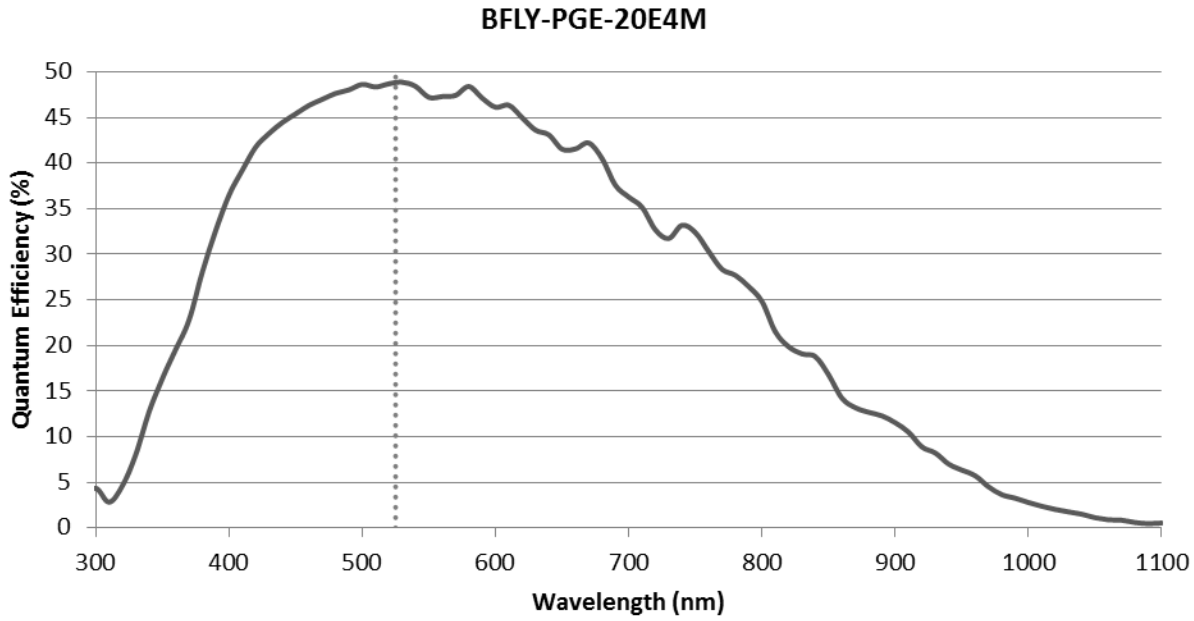
16 BFLY-PGE-14S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	60 FPS
Pixel Clock (MHz)	99
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	62
Quantum Efficiency Green (% at 525 nm)	70
Quantum Efficiency Red (% at 640 nm)	48
Temporal Dark Noise (Read Noise) (e-)	3.90
Signal to Noise Ratio Maximum (dB)	42.98
Signal to Noise Ratio Maximum (Bits)	7.14
Absolute Sensitivity Threshold (γ)	6.60
Saturation Capacity (Well Depth) (e-)	19851
Dynamic Range (dB)	73.08
Dynamic Range (Bits)	12.14
Gain (e-/ADU)	0.31



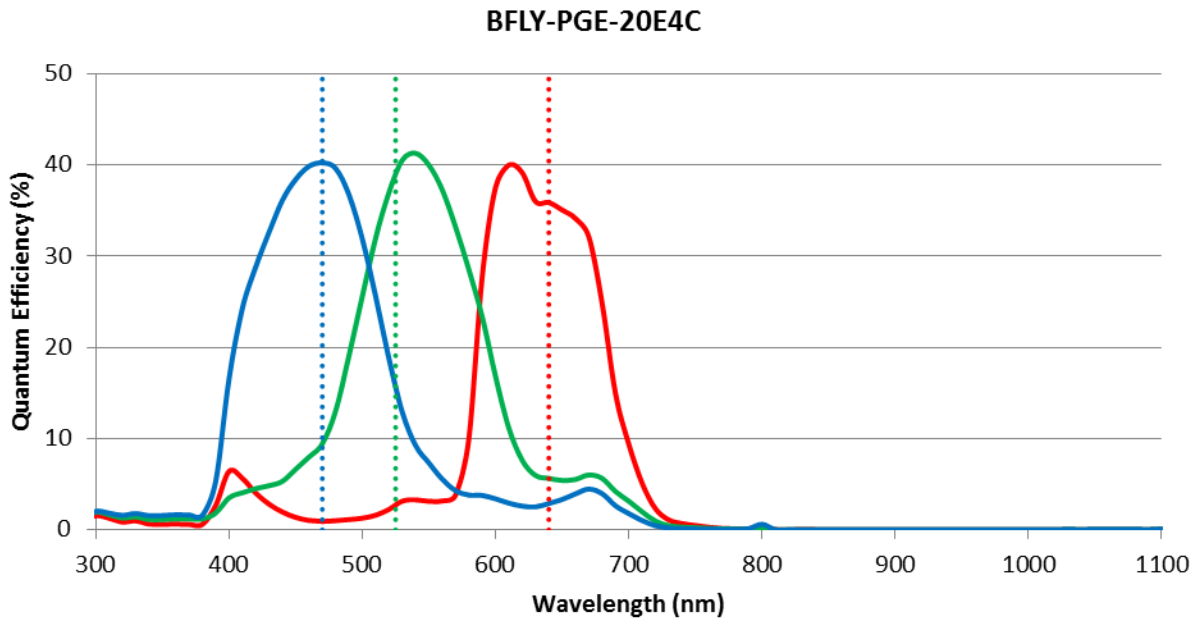
17 BFLY-PGE-20E4M-CS Imaging Performance

Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	47 FPS	47 FPS
Pixel Clock (MHz)	114	114
ADC (Bits)	10-bit	10-bit
Quantum Efficiency (% at 525 nm)	48	49
Temporal Dark Noise (Read Noise) (e-)	21.28	7.37
Signal to Noise Ratio Maximum (dB)	38.94	40.36
Signal to Noise Ratio Maximum (Bits)	6.47	6.70
Absolute Sensitivity Threshold (γ)	42.26	16.00
Saturation Capacity (Well Depth) (e-)	7836	10866
Dynamic Range (dB)	51.12	62.80
Dynamic Range (Bits)	8.49	10.43
Gain (e-/ADU)	0.13	0.20



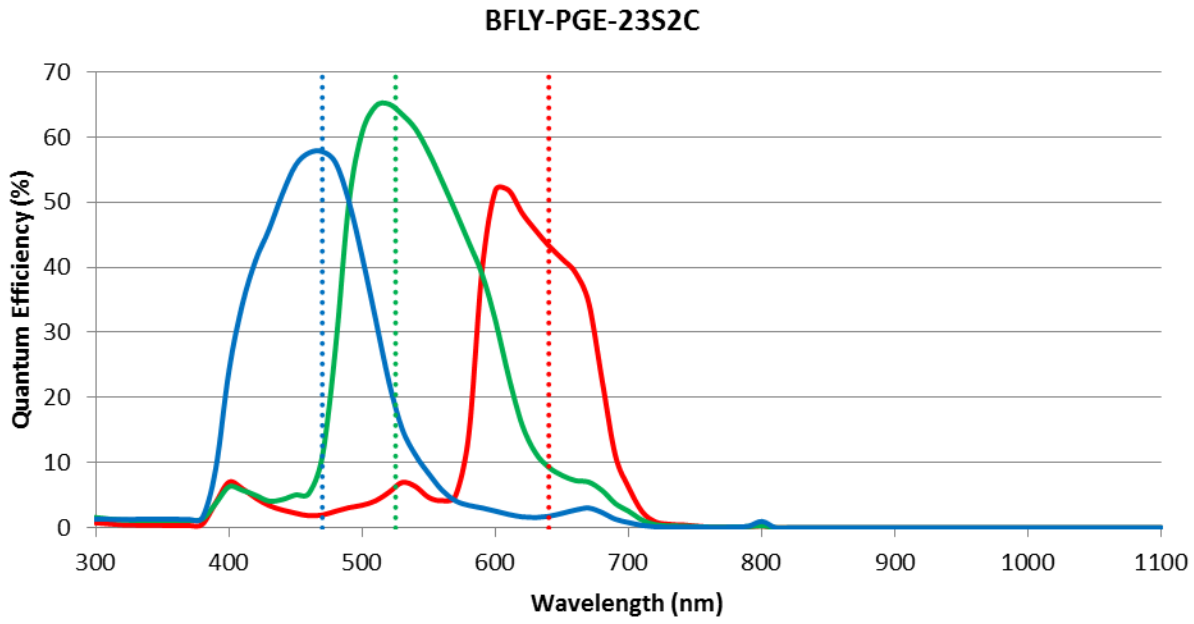
18 BFLY-PGE-20E4C-CS Imaging Performance

Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	47 FPS	47 FPS
Pixel Clock (MHz)	114	114
ADC (Bits)	10-bit	10-bit
Quantum Efficiency Blue (% at 470 nm)	40	41
Quantum Efficiency Green (% at 525 nm)	38	40
Quantum Efficiency Red (% at 640 nm)	35	36
Temporal Dark Noise (Read Noise) (e-)	20.87	6.90
Signal to Noise Ratio Maximum (dB)	38.66	40.26
Signal to Noise Ratio Maximum (Bits)	6.42	6.69
Absolute Sensitivity Threshold (γ)	57.39	19.12
Saturation Capacity (Well Depth) (e-)	7337	10623
Dynamic Range (dB)	50.71	63.14
Dynamic Range (Bits)	8.42	10.49
Gain (e-/ADU)	0.12	0.20



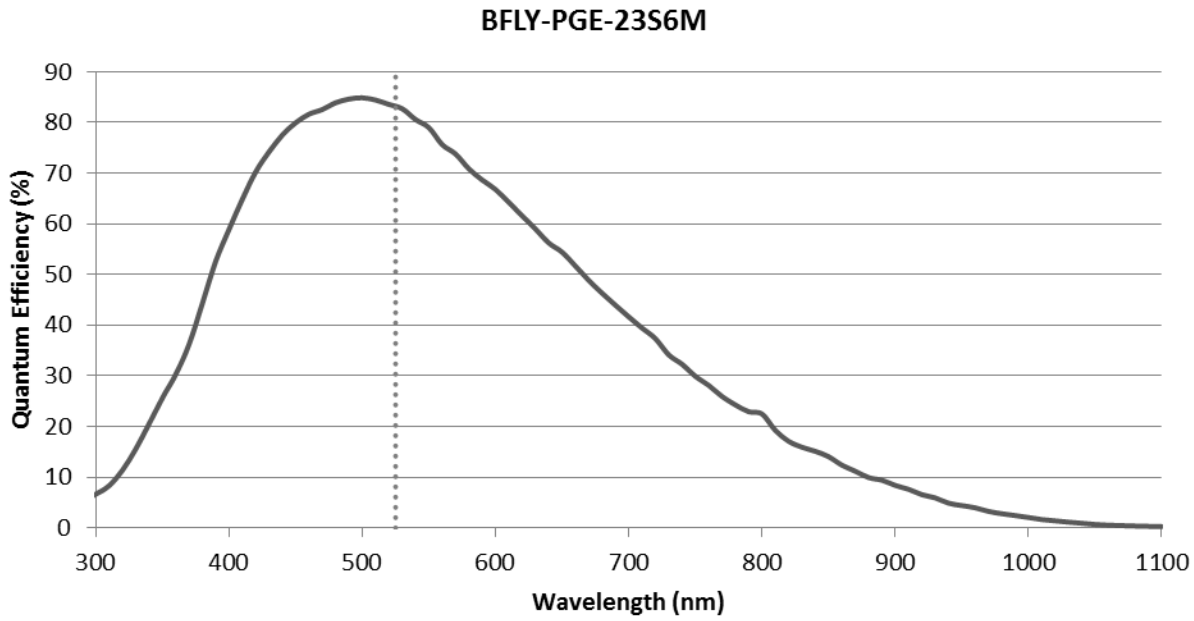
19 BFLY-PGE-23S2C-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	27 FPS
Pixel Clock (MHz)	74.25
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	58
Quantum Efficiency Green (% at 525 nm)	64
Quantum Efficiency Red (% at 640 nm)	44
Temporal Dark Noise (Read Noise) (e-)	4.06
Signal to Noise Ratio Maximum (dB)	41.36
Signal to Noise Ratio Maximum (Bits)	6.87
Absolute Sensitivity Threshold (γ)	7.52
Saturation Capacity (Well Depth) (e-)	13688
Dynamic Range (dB)	69.55
Dynamic Range (Bits)	11.55
Gain (e-/ADU)	0.25



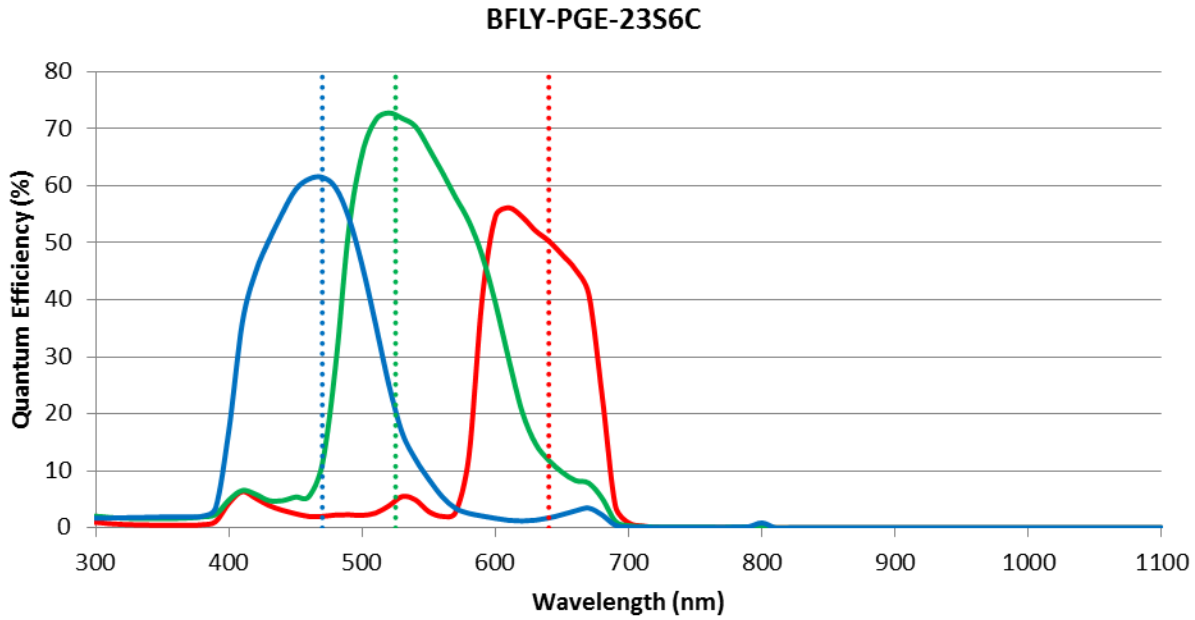
20 BFLY-PGE-23S6M-C Imaging Performance

Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	41 FPS	32 FPS
Pixel Clock (MHz)	37.5	37.5
ADC (Bits)	10-bit	12-bit
Quantum Efficiency (% at 525 nm)	82	82
Temporal Dark Noise (Read Noise) (e-)	14.31	10.33
Signal to Noise Ratio Maximum (dB)	45.16	45.29
Signal to Noise Ratio Maximum (Bits)	7.50	7.52
Absolute Sensitivity Threshold (γ)	18.58	13.49
Saturation Capacity (Well Depth) (e-)	32810	33809
Dynamic Range (dB)	66.71	69.89
Dynamic Range (Bits)	11.11	11.61
Gain (e-/ADU)	0.52	0.53



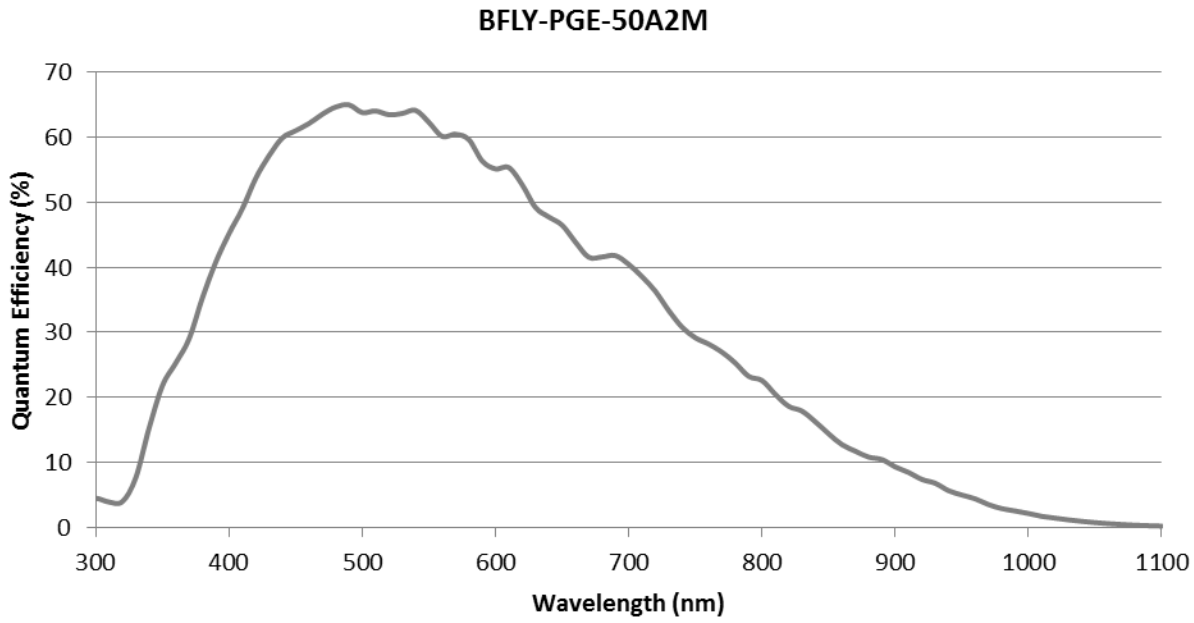
21 BFLY-PGE-23S6C-C Imaging Performance

Measurement	Video Mode 0	Video Mode 7
Frame Rate (FPS)	41 FPS	32 FPS
Pixel Clock (MHz)	37.5	37.5
ADC (Bits)	10-bit	12-bit
Quantum Efficiency Blue (% at 470 nm)	64	62
Quantum Efficiency Green (% at 525 nm)	75	72
Quantum Efficiency Red (% at 640 nm)	52	50
Temporal Dark Noise (Read Noise) (e-)	15.06	6.97
Signal to Noise Ratio Maximum (dB)	45.25	45.28
Signal to Noise Ratio Maximum (Bits)	7.51	7.52
Absolute Sensitivity Threshold (γ)	21.89	10.93
Saturation Capacity (Well Depth) (e-)	33456	33723
Dynamic Range (dB)	66.65	73.09
Dynamic Range (Bits)	11.07	12.14
Gain (e-/ADU)	0.53	0.53



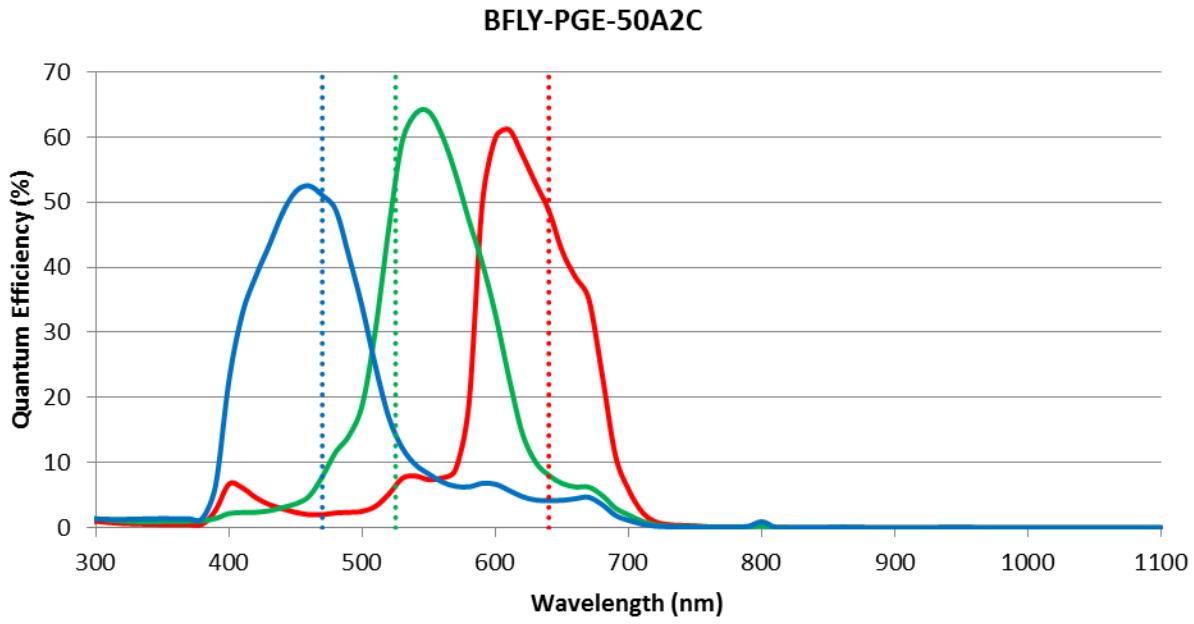
22 BFLY-PGE-50A2M-CS Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	13 FPS
Pixel Clock (MHz)	96
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	63
Temporal Dark Noise (Read Noise) (e-)	7.64
Signal to Noise Ratio Maximum (dB)	38.26
Signal to Noise Ratio Maximum (Bits)	6.35
Absolute Sensitivity Threshold (γ)	13.00
Saturation Capacity (Well Depth) (e-)	6693
Dynamic Range (dB)	58.30
Dynamic Range (Bits)	9.68
Gain (e-/ADU)	0.11



23 BFLY-PGE-50A2C-CS Imaging Performance

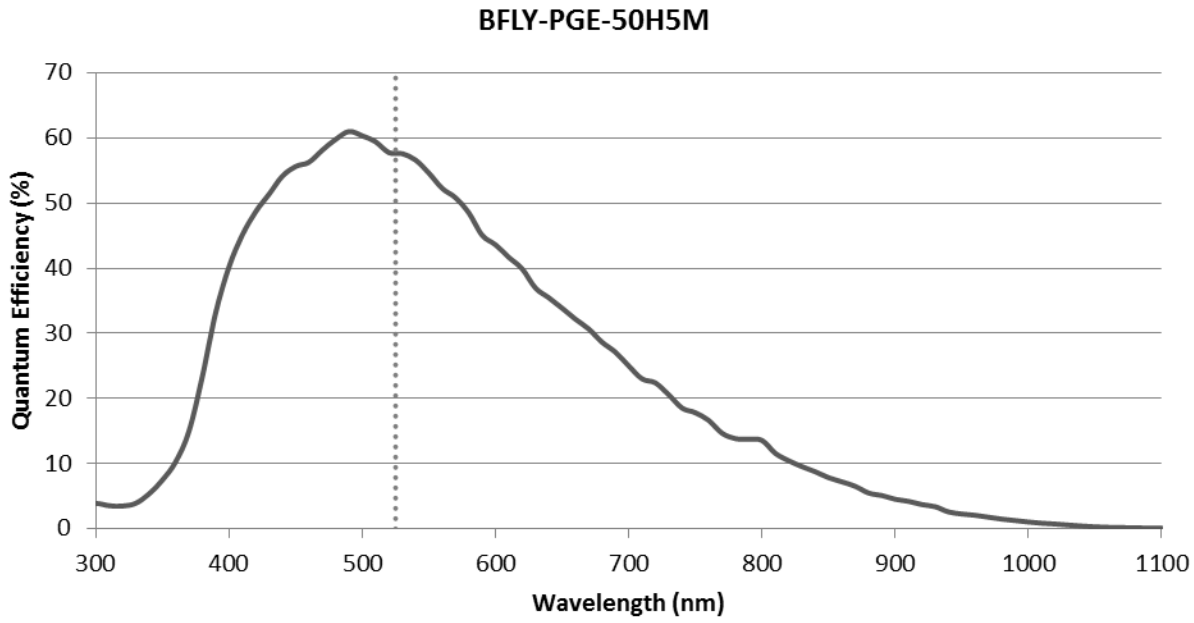
Measurement	Video Mode 0
Frame Rate (FPS)	13 FPS
Pixel Clock (MHz)	96
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	51
Quantum Efficiency Green (% at 525 nm)	52
Quantum Efficiency Red (% at 640 nm)	48
Temporal Dark Noise (Read Noise) (e-)	5.30
Signal to Noise Ratio Maximum (dB)	36.81
Signal to Noise Ratio Maximum (Bits)	6.11
Absolute Sensitivity Threshold (γ)	11.26
Saturation Capacity (Well Depth) (e-)	4796
Dynamic Range (dB)	58.35
Dynamic Range (Bits)	9.69
Gain (e-/ADU)	0.08



24 BFLY-PGE-50H5M-C Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	7.5 FPS
Pixel Clock (MHz)	45
ADC (Bits)	12-bit
Quantum Efficiency (% at 525 nm)	57
Temporal Dark Noise (Read Noise) (e-)	5.48
Signal to Noise Ratio Maximum (dB)	39.08
Signal to Noise Ratio Maximum (Bits)	6.49
Absolute Sensitivity Threshold (γ)	10.67
Saturation Capacity (Well Depth) (e-)	8086
Dynamic Range (dB)	62.61
Dynamic Range (Bits)	10.4
Gain (e-/ADU)	0.13

Measurements taken with Raw16 pixel format.



25 BFLY-PGE-50H5C-C Imaging Performance

Measurement	Video Mode 0
Frame Rate (FPS)	7.5 FPS
Pixel Clock (MHz)	45
ADC (Bits)	12-bit
Quantum Efficiency Blue (% at 470 nm)	44
Quantum Efficiency Green (% at 525 nm)	49
Quantum Efficiency Red (% at 640 nm)	32
Temporal Dark Noise (Read Noise) (e-)	5.64
Signal to Noise Ratio Maximum (dB)	39.08
Signal to Noise Ratio Maximum (Bits)	6.49
Absolute Sensitivity Threshold (γ)	13.15
Saturation Capacity (Well Depth) (e-)	8096
Dynamic Range (dB)	62.40
Dynamic Range (Bits)	10.36
Gain (e-/ADU)	0.13