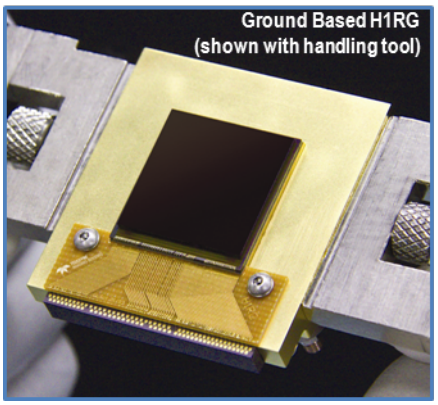
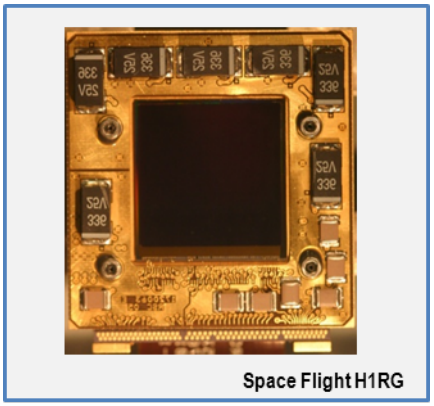
Teledyne Imaging Sensors
HgCdTe H1RG™ Focal Plane Array

The 1024×1024 pixel H1RG™ is a large-format readout integrated circuit for visible and infrared astronomy in ground-based and space based applications.





- Large (1024×1024 pixel) array with 18 µm pixel pitch.
- Compatible with Teledyne Imaging Sensors (TIS) HgCdTe infrared (IR) and silicon PIN HyViSI™ visible detectors, providing sensing of any spectral band from soft X-ray to 10 µm.
- Standard product HgCdTe cutoffs are 1.75 m, 2.3 m, 2.5 m, and 5.3 m.
- Substrate-removed HgCdTe quantum efficiency (QE), enables response through the visible spectrum, eliminates fluorescence from cosmic radiation absorbed in the substrate, and eliminates fringing in the substrate material.
- Reference rows and columns for common-mode noise rejection.
- Guide window output – windowing with simultaneous science date acquisition of full array. Programmable window location and size which may be read out at up to 5 MHz pixel rate for guiding. Readout is designed to allow interleaved readout of the guide window and the full frame science data.
- Selectable number of outputs (1, 2, or 16) and user-selectable scan directions provide flexibility in data acquisition.
- Full-frame readout rates from less than 0.1 Hz to 132 Hz.
- Fully compatible with the Teledyne's new SIDECAR™ ASIC Module (SMd) Focal Plane Electronics.
- Qualified for Space applications (NASA technical readiness level 9 (TRL-9))
- Packaging materials available: molybdenum or invar

H1RG™ specification table for infrared arrays

Parameter	Unit	Value			
		1.7 m	2.3 m	2.5 m	5.3 m
Array Format [1]		1024 x 1024 pixel, 18 m pitch			
Number of Outputs	#	Programmable 1, 2, 16			
Frame rate	Hz	6 (slow mode, 480 Kpix/sec/output, 16 outputs) 132 (fast mode, 10 Mpix/sec/output, 16 outputs)			
Power Dissipation	mW	≤ 2 [2] / ≤ 100 [3]			
Detector Material		HgCdTe			
Detector Substrate		CdZnTe - Removed			
Cutoff wavelength (50% of peak QE):	m	1.65 - 1.80 (at 120 K)	2.25 - 2.35 (at 100 K)	2.45 – 2.65 (at 77 K)	5.1 - 5.5 (at 37 K)
Mean Quantum Efficiency (QE) at 800 nm *	%	≥ 50 (goal is ≥ 70)	≥ 55 (goal is ≥ 75)	≥ 70 (goal is ≥ 80)	
Mean Quantum Efficiency (QE) at 1,000 nm *	%	≥ 50 (goal is ≥ 70)	≥ 55 (goal is ≥ 75)	≥ 70 (goal is ≥ 80)	
Mean Quantum Efficiency (QE) at 1,230 nm *	%	≥ 70 (goal is ≥ 80)	≥ 70 (goal is ≥ 80)		
Mean Quantum Efficiency (QE) at 1,500 nm *	%	≥ 70 (goal is ≥ 80)	≥ 70 (goal is ≥ 80)		
Mean Quantum Efficiency (QE) at 2,000 nm *	%	0	≥ 70 (goal is ≥ 80)		
Mean Quantum Efficiency (QE) at 3,500 nm *	%	0			≥ 70 (goal is ≥ 80)
Mean Quantum Efficiency (QE) at 4,400 nm *	%	0			≥ 70 (goal is ≥ 80)
Median Dark current	e-/s	≤ 0.05 (goal is ≤ 0.01)			
		0.25 V bias and 120 K	0.5 V bias and 100 K	0.5 V bias and 77 K	0.18 V bias and 37 K
Median Readout Noise, correlated double sampling (CDS) at 100 KHz pixel readout rate	e-	≤ 30 (goal is ≤ 15)	≤ 15.5 (goal is ≤ 12)	≤ 15 (goal is ≤ 12)	
Median Readout Noise, reset - read at 10 MHz pixel readout rate	e-	≤ 100 (goal is ≤ 70)			
Well Capacity at 0.25 – 0.5V bias (0.175V bias for 5.3 m cutoff)	e-	≥ 80,000 (goal is ≥ 100,000)			≥ 65,000 (goal is ≥ 85,000)
Crosstalk [4]	%	≤ 3 total (goal is ≤ 2) ≤ 2 IPC (goal is ≤ 1)			≤ 4 total (goal is ≤ 2) ≤ 2 IPC (goal is ≤ 1)
Operability [5]	%	≥ 95 (goal is ≥ 99)			
Cluster: 50 or more contiguous inoperable pixels	%	≤ 1 (goal is ≤ 0.5) of array			
Latency (80% of Full Well Illumination) [6]	%	0.1			
Response Uniformity (sigma/mean)	%	≤ 5 total array (goal is ≤ 3)			
SCA Flatness [8]	m	≤ 20 (goal is ≤ 10)			

(1) There are 1016 x 1016 pixels for light detection plus 4 rows and columns of reference pixels on each side of the array
(2) At 100 kHz pixel read-out rate, unbuffered, 16 outputs. Does not include external current source; power has to be optimized with respect to the system in which the device is used
(3) At 10 MHz pixel read-out rate, buffered, 16 outputs
(4) Crosstalk includes both optical (charge diffusion) and electrical (interpixel capacitance) components
(5) A pixel is considered operable if QE ≥ 35%, dark current ≤ 0.1 e-/sec, and single correlated double sample (CDS) noise is ≤35 e-
(6) Measured as the ratio of the difference between post-illumination samples 2 and 3 to the illumination level, with 2 resets after illumination
(7) Calculation of sigma/mean excludes inoperable pixels.
(8) Maximum variation (peak-to-valley) to best fit plane
* Average over the band when a curve fit of the AR coating model is fit to the measurements at discrete LED wavelengths