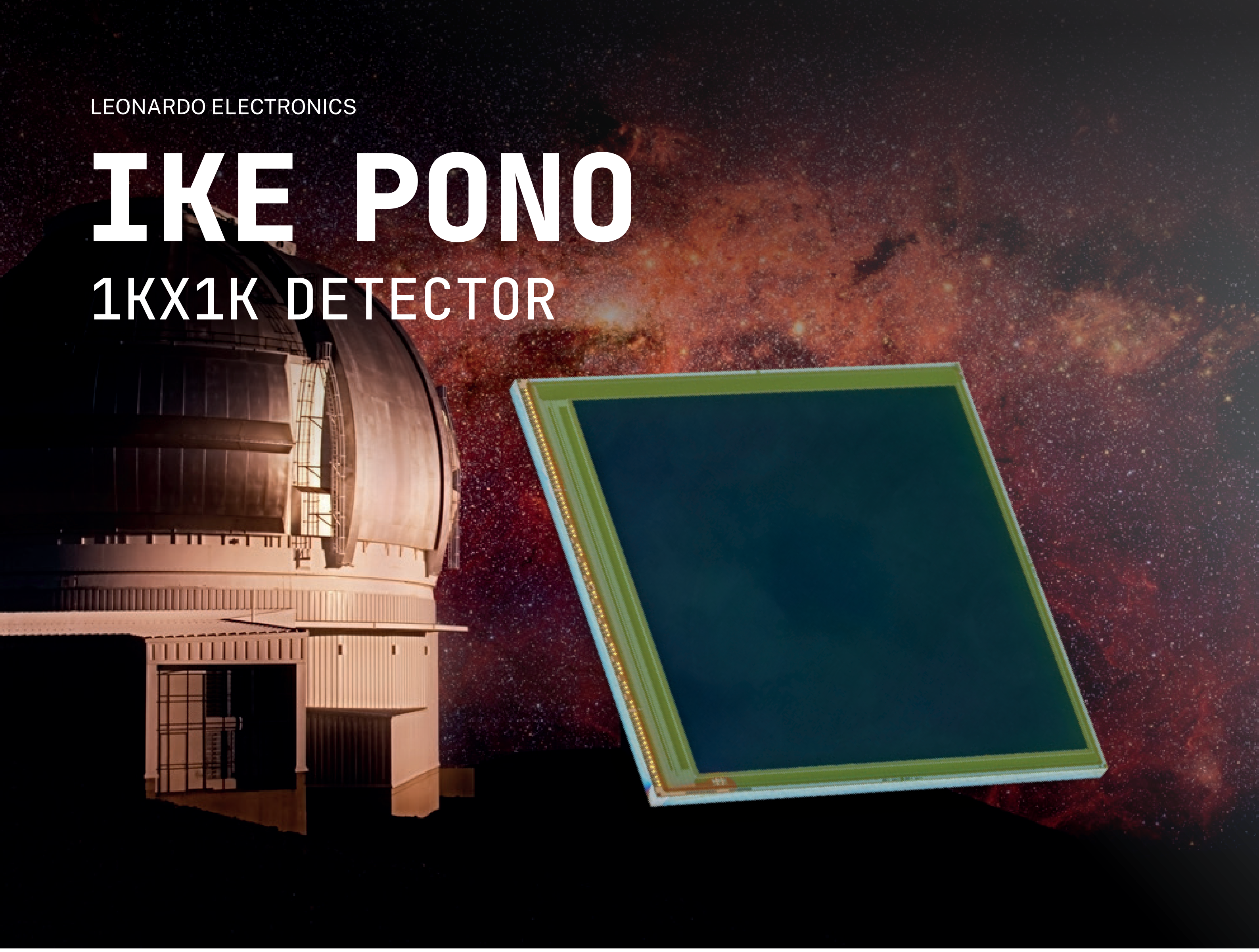
LEONARDO ELECTRONICS

IKE PONO

1KX1K DETECTOR



'Ike Pono' was named by the late Donald Hall of the University of Hawaii – who inspired its design - after the Hawaiian for 'far-seeing'. The array has 1024x1024 active pixels and a 15x15 micron pixel arranged on a 15 micron pitch. Ike Pono is the product of many years of research and development alongside the University of Hawaii, Institute of Astronomy on avalanche photodiode sensors for astronomical imaging.

The array is designed specifically for HgCdTe avalanche photodiodes that are fundamental to achieve the sensitivity needed by future astronomical instruments. Very weak signal levels down to a few photons per kilosecond and long exposure times up to many days present very special demands on the focal plane array. Ike Pono has non-destructive readout so multiple frames can be acquired during the exposure to employ noise reduction techniques, such as 'down-the-ramp'. The array has comprehensive reference pixels that enable any fluctuations in power supply voltages or temperature during long exposures to be compensated.

Self-luminescence (glow) from the silicon components has been minimised by a combination of integrated circuit component design, operating with very low voltages and dedicating the top two layers of metal as blocking layers. There are 16 parallel outputs to enable slow clocking and heavy noise filtering.

The HgCdTe avalanche photodiode array (APD) is crucial to the performance of the device. Leonardo photodiodes use metal-organic vapour-phase epitaxy, MOVPE, as the growth process and this provides complete flexibility of bandgap and doping levels. APDs use a separate absorber and multiplication layer so all the photons receive the same avalanche gain. The absorber is continuous providing 100% fill factor and near 100% internal QE. The mesa device technology results in complete separation of the pixels minimising inter-pixel capacitance and crosstalk.

LEONARDO

The dark current characteristics of APDs for astronomical applications are crucial. In collaboration with the University of Hawaii the latest Ike Pono arrays demonstrate dark currents less than 0.001 e/s/pix with an avalanche gain of 10x at 70K. A read noise of <1 electron rms has been measured setting a new standard in sensitivity by almost an order of magnitude. Future research activity will focus on further improvements in gain at these dark current levels.

The consequence of using Ike Pono with APD gain over conventional infrared detectors is that faint signals that were previously buried in noise and unresolvable can now be resolved. For many instruments, such as spectrometers, this is crucial as conventional detectors may need prohibitively long exposures. The shorter exposure times for APD arrays (for the same signal-to-noise value) can maximise the science return on large telescopes. Currently Ike Pono is aimed at imaging faint single objects where an array size of 1kx1k is appropriate. A 2kx2k version of Ike Pono is planned in the near future.

TECHNICAL SPECIFICATION

Packaging Option

Currently offered as a bare array or in a customer package
Please contact us to discuss packaging options

Technical Specifications (Physical Parameters)

Array	1024 x 1024 pixels
Pixel Pitch	15 µm

Technical Specifications (ROIC Operation)

Reset modes	Global or rolling
CDS modes	Rolling or Read-Reset-Read per row
Control and operation	Single serial interface and clock
Power consumption	30 mW
Number of outputs	16
Maximum frame rate	32 frames per second
Windowing	Multiple window options
Avalanche gain control	Single –ve power supply up to 18 V

Technical Specifications (Infrared Imaging)

Infrared sensor	HgCdTe avalanche photodiodes
Waveband for full gain	0.8 to 2.5 um (partial to 3.5 um)
Typical read noise	1 electron at a typical gain of x25
Noise figure	< 1.2
Maximum gain	100x
Operating temperature	40 to 140 K
Dark current	0.001 e/s/pixel at 70 K

For more information:
infomarketing@leonardo.com

Leonardo Electronics
Sigma House - Christopher Martin Road - Basildon - Essex SS14 3EL - United Kingdom
T +44 (0) 1268 522822

LDO_UK23_00360 04-24