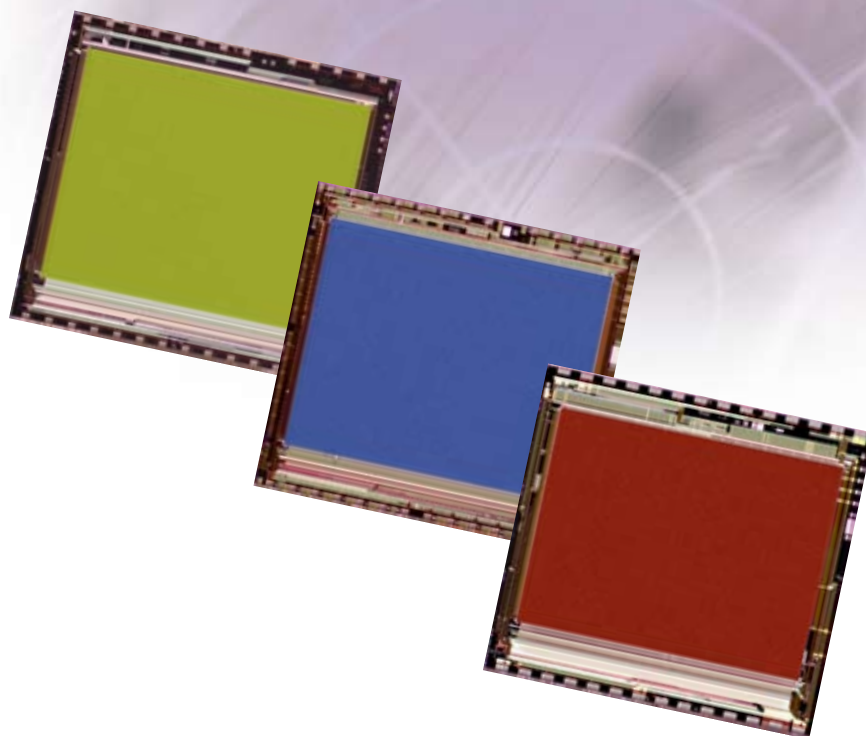


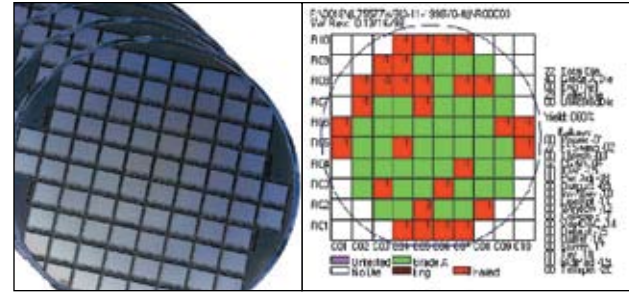
Mid-Format Readout Integrated Circuits

Standard Readout Integrated Circuits -
at the heart of today's vision systems



Readout Integrated Circuits

If you're designing imaging systems for Infrared, Visible, Ultraviolet, X-ray, or Gamma Ray detection, FLIR's mixed-signal Readout Integrated Circuits (ROICs) offer a proven design, without the schedule, resources, and risk of a custom development. Our line of ROIC products provides an off-the-shelf solution for applications requiring low noise, variable charge storage capacitance, selectable integration times, adjustable gain and power settings, and a simple user interface.



ROICs in wafer form with test data CD

2-Dimensional Arrays

We offer a family of 2-dimensional mid-format arrays including the ISC9705, ISC9809, ISCO208, ISCO006, and ISCO207. These arrays make excellent imagers for camera products, and are used in Indigo's Alpha NIR, Cumulus and Phoenix IR cameras. The ISC9809, with ultra-low noise and low background sensitivity, is ideal for spectroscopy and astronomy applications. It's also compatible with ultra-violet and visible sensors.

- Formats including 320 x 256, and 384 x 288 elements
- Designed for use with infrared detectors including InSb, QWIP and InGaAs
- Common electrical interfaces and features
- Evaluation electronics kits available for use with ISC9705

Linear Array

Our linear array, the ISC9802, is a 512 x 1 device for photodiodes. It is ideal for use in spectroscopy systems and DWDM channel monitors.

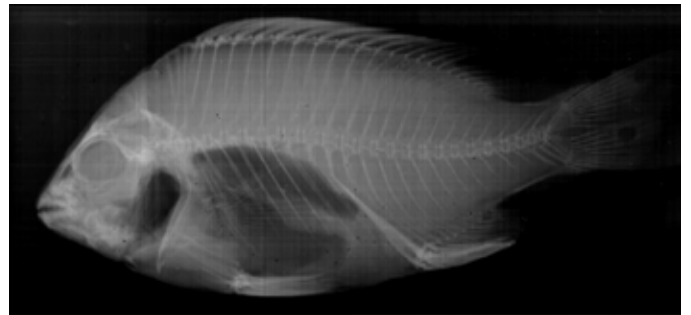
- Supports both wire- and bump-bonding detector interfaces
- User-configurable as a 512 x 1, 256 x 1, or 128 x 1 array
- Low noise, low input impedance front end, correlated double sampling stage, and wide range of selectable integration capacitors

X-ray Devices

The ISC9717, our 128 x 1 ROIC for X-ray detection systems, offers the ultimate in flexible architecture. It supports applications involving digital radiography, mammography, fluoroscopy, angiography, tomography, non-destructive testing, or industrial instrumentation.

The ISC9717 is ideal for X-ray medical imaging applications, from high-resolution radiography in single frame mode to fluoroscopy with up to 30Hz frame rates.

- Designed for use with Se, CsI, Si, Amorphous Si, GaAs, and CdZnTe detectors
- Adjustable parameters for integration capacitor selection, low-pass filter time constant, gain, integration mode, ADC resolution, and readout direction
- Designed for abutting multiple chips to read out large array flat panel X-ray detector panels



ISC9717 ROIC and X-Ray image of a scup taken by tiling two 1024 x 1024 frames horizontally.



Delivery

Standard ROIC devices are delivered in wafer form, probe tested and labeled according to pass/fail criteria. Test data is included on CD-ROM for each device. A User Guide is provided that describes all device electrical interfaces. A Mechanical Interface Database provides the layout information needed by customers to design their detector interface.

If our standard ROIC products do not meet your requirements, we offer full custom design services, from trade study through design and fabrication of wafers.



Standard Readout Functions

	ISC9705	ISC9809	ISC0208	ISC0006	ISC9802 (linear array)	ISC9717 (linear X-Ray)
Array Size	320 x 256	320 x 256	384 x 288	320 x 256	512 x 1 (256 x 1, 128 x 1)	128 x 1
Pixel Pitch	30 μ m	30 μ m	25 μ m	40 μ m	25 μ m, 50 μ m, 100 μ m	80 μ m
Input Circuit	Direct Injection	CTIA	Direct Injection	Direct Injection	CTIA	CTIA
Integration Type	Snapshot mode	Snapshot mode	Snapshot mode	Snapshot mode	Snapshot mode	Snapshot mode
Integration Time	Adjustable integration time > 5 μ s	Adjustable integration time > 0.5 μ s*	Adjustable integration time > 9.6 μ s	Adjustable integration time > 53 μ s	Adjustable integration time > 0.2 μ s	Adjustable integration time 24 μ s to few ms
Integration Modes	Integrate-While-Read Integrate-Then-Read	Integrate-While-Read Integrate-Then-Read Non-destructive readout Continuous integ. with multiple readout	Integrate-While-Read Integrate-Then-Read	Integrate-Then-Read	Integrate-While-Read Integrate-Then-Read	Integrate-While-Read Integrate-Then-Read
Gain Adjustment	2 bit (1, 1.3, 2 or 4x)	1 bit (1, 20x)	2 bit (1, 1.3, 2 or 4x)	2 bit (each Color) (1, 1.3, 2 or 4x)	3 bit integ. capacitor 2 bit CDS gain (1, 1.3, 2 or 4x)	3 bit integ. capacitor 4 bit CDS gain (1, 2, 4, 8 or 32x)
Operational Modes	"Hands-off" default or User configurable	"Hands-off" default or User configurable	"Hands-off" default or User configurable	"Hands-off" default or User configurable	"Hands-off" default or User configurable	Programmable Low Pass Filter Programmable 9 to 14bit ADC
Windowing	Dynamic windowing Window size - position	Dynamic windowing Window size - position	Dynamic windowing Window size - position	N/A	N/A	Adjacent channel averaging mode
Readout Modes	Invert [row] Revert [column] Inverse [row-column] Line repeat mode	Invert [row] Revert [column] Inverse [row-column] Line repeat mode	Invert [row] Revert [column] Inverse [row-column]	Integrate both colors simultaneously separate integration control on each color		
Number of Outputs	Selectable 1, 2 or 4 Refer. output	Selectable 1, 2 or 4 Refer. output	Selectable 1, 2 or 4 Refer. output	2 output	1 or 2 (odd/even) for 512 Refer. output	Parallel output 9 to 14 bits (current mode)
Detector Application	p-on-n	p-on-n or n-on-p	p-on-n	p-on-n	p-on-n or n-on-p	Hole or e ⁻ collection, direct or indirect detector interface

* Dependent upon operating temperature and internal bias and amplifier settings.

Specifications

	ISC9705	ISC9809	ISCO208	ISCO006	ISC9802 (linear array)	ISC9717 (linear X-ray)
Array Size		320 x 256	320 x 256	320 x 256 x 2	512 x 1	128 x 1
Pixel Pitch	30 μm	30 μm	25 μm	40 μm	25 μm , 50 μm , 100 μm	80 μm
Operating Temperatures	77 K to 310 K	77 K to 310 K	77 K to 310 K	60 K to 75 K Stability <0.1K	77 K to 340 K	283 K to 333 K
Detector Bias Range ($I_{\text{det}} = 1\text{nA}$)	-0.10 V to 0.5 V (up to 0.8 V)+	0 to 2.5 V	0 to 0.5 V+	VDETCOM - (5.29 to 3.32V)	-0.25 V to 0.25 V Uniformity $\leq 250 \mu\text{V}$	1.5-3.5 V
Detector Bias Resolution	5 mV	External adjust.	5 mV	63mV steps or external adjust	External adjust	External adjust
R_{oAd} Min.	$\geq 1 \times 10^3 \Omega \cdot \text{cm}^2$	$\geq 10 \times 10^7 \Omega \cdot \text{cm}^2$	$\geq 1 \times 10^3 \Omega \cdot \text{cm}^2$	$\geq 1.6 \times 10^5 \Omega \cdot \text{cm}^2$	$\geq 10^{10} \Omega \cdot \text{cm}^2$	N/A
Detector Capacitance Max.	$\leq 0.5 \text{ pF}$	$\leq 0.1 \text{ pF}$	$\leq 0.5 \text{ pF}$	$\leq 0.5 \text{ pF}$	$< 10 \text{ pF}$	$\leq 50 \text{ pF}$
Well Capacity (Min-Max Gain)	18 x 10 ⁶ e ⁻ 13.5 x 10 ⁶ e ⁻ 9 x 10 ⁶ e ⁻ 4.5 x 10 ⁶ e ⁻	3.5 x 10 ⁶ e ⁻ 170 x 10 ³ e ⁻	18.5 x 10 ⁶ e ⁻ 13.9 x 10 ⁶ e ⁻ 9.3 x 10 ⁶ e ⁻ 3.3 x 10 ³ e ⁻	MWIR: > 17 x 10 ⁶ e ⁻ LWIR: > 87 x 10 ⁶ e ⁻ MWIR: > 12.8 x 10 ⁶ e ⁻ LWIR: > 65.4 x 10 ⁶ e ⁻ MWIR: > 8.5 x 10 ⁶ e ⁻ LWIR: > 43.5 x 10 ⁶ e ⁻ MWIR: > 4.3 x 10 ⁶ e ⁻ LWIR: > 21.8 x 10 ⁶ e ⁻	256 x 10 ⁶ e ⁻ to 2 x 10 ⁶ e ⁻ (in 8 increments)	75 x 10 ⁶ e ⁻ 9.3 x 10 ⁶ e ⁻ (in 8 increments)
Input Current (Nominal Operating Range)*	1 pA 1 nA 10 nA	.01 pA 1 pA 50 nA	1 pA 1 nA 20 nA	14pA MWIR: 57pA LWIR: 365pA 1.0nA	Depends on T _{int}	Depends on T _{int}
ROIC Noise (Min. Gain)	$\leq 900 \text{ e}^{\text{RMS}*}$	$\leq 700 \text{ e}^{\text{RMS}*}$	$\leq 850 \text{ e}^{\text{RMS}*}$	MWIR < 1200 e ⁻ * LWIR < 4000 e ⁻ *	$\leq 3700 \text{ e}^{\text{RMS}}$	$\leq 17000 \text{ e}^{\text{RMS}*}$ (low speed)*
ROIC Noise (Max. Gain)	$\leq 600 \text{ e}^{\text{RMS}*}$	$\leq 70 \text{ e}^{\text{RMS}*}$	$\leq 570 \text{ e}^{\text{RMS}*}$	MWIR < 600 e ⁻ * LWIR < 1600 e ⁻ *	$\leq 100 \text{ e}^{\text{RMS}}$ (high speed)**	$\leq 2000 \text{ e}^{\text{RMS}**}$
Output Range	3 V	2.7 V	2.5 V	< 2.0V	2.5 V	0.5 mA $\pm 10\%$ /bit
Output Interface (R _{out} , C _{out})	> 100 k Ω $\leq 25 \text{ pF}$	> 500 k Ω $\leq 25 \text{ pF}$	> 100 k Ω $\leq 25 \text{ pF}$	> 100 k Ω $\leq 25 \text{ pF}$	> 100 k Ω $\leq 25 \text{ pF}$	N/A $\leq 30 \text{ pF}$
Pixel rate	10 MHz	10 MHz	10 MHz	6.25MHz	3.85 MHz (at 77 K) 2.7 MHz (at 300 K)	12.5 MHz
Full Frame Rate (1 output)	110 Hz	110 Hz	80 Hz	N/A	7.1 kHz (at 77 K) 5 kHz (at 300 K)	0.9 Hz for 14 bit up to 36 Hz for 9 bit
Full Frame Rate (2 outputs)	200 Hz	200 Hz	150 Hz	30Hz	14 kHz (at 77 K) 9.8 kHz (at 300 K)	N/A
Full Frame Rate (4 outputs)	346 Hz	346 Hz	260 Hz	N/A	N/A	N/A
Power (1 output)	$\leq 30 \text{ mW}$	$\leq 100 \text{ mW}$	$\leq 75 \text{ mW}$	$\leq 100\text{mW}$, 2 outputs	$\leq 55 \text{ mW}$ (256)***	$\leq 256 \text{ mW}$
Power (4 outputs)	$\leq 120 \text{ mW}$	$\leq 175 \text{ mW}$	$\leq 160 \text{ mW}$	N/A	$\leq 110 \text{ mW}$ (512)***	$\leq 2 \text{ mW}$ per Channel

*Dependent upon
T_{int} and operating
conditions

*T_{int} = 1 msec
T = 80 K
+ QWIP Bias option
available

*T_{int} = 16 msec,
T = 250 K
C_{det} + C_{int} = 0.126 pF
R_{oA} $\geq 5 \times 10^4 \Omega \cdot \text{cm}^2$

*theoretical,
no detector or
system noise
+ QWIP Bias with
option available

Based on f/2,
295K, optics
= 50%
C_{det} = 0.05pF
R_{oA} \geq
1.6x10⁵ $\Omega \cdot \text{cm}^2$

*T_{int} = 10 msec,
T = 300 K,
C_{det} = 0.5pF
**T_{int} = 0.2 msec,
T = 80 K, no CDS,
ITR, C_{det} = 0.5pF
*** T = 300 K
(x1.4 @ 77 K)

*C_{int} = 4pF,
x1 CDS, 14 bit ADC,
C_{det} = 50pF
**C_{int} = 0.5pF,
x32 CDS, 9 bit ADC,
C_{det} = 50pF



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