Version 100 – initial release Nov. 2004 for version 100 of the ROIC design
Version 200 – updated release per version 200 of the ROIC design – July 2005

ISC0403
Standard 640x512 ROIC
(15umx15um Pixel)

ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Array Configuration	640 x 512	
Pixel Size in Columns	15um	
Detector Impedance	> $10x10^3$ (Ohm.cm^2)	Used for Simulation
Detector Capacitance	≤ 0.1pF	Used for Simulation
Crosstalk	< 20%	
Signal Loss due to Fill Factor	< 5%	
Hybridization	Indium Bump	

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Array Configuration	640 x 512	
Pixel Pitch in Columns	15um	
Pixel Pitch in Rows	15um	
Input Polarity	P-on-N	(Current Flows into Inputs) InSb, InGaAs, HCT
Input Configuration	Direct Injection (DI)	
Core Multiplexing Configuration	Voltage Mode	
Detector Impedance	≥ $10x10^3$ ($Ohm.cm^2$)	Used for Simulation
Detector Capacitance	≤ 0.1pF	Used for Simulation
Temperature of Operation	80K (Liquid Nitrogen Temperature)	All specification specified for 80K. Room temperature operation will have reduced performance

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Input Biases	VPOS 3.6V VPOSOUT 3.6V VPOSD 3.6V VPD 3.6V VNEG 0.0V VNEGOUT 0.0V VND 0.0V VREF 1V	Analog Positive Output Positive Supply Digital Positive for level shifter Digital Positive Note: VPD Voltage Should = VPOSOUT Voltage Analog Negative Output Neg Supply Digital Negative Analog Reference VREF 1V (Option: Internal or external reference) → 7 feedthroughs + 1 optional (VREF)
Input Clocks **Input Clock**	Name Vhigh to Vlow CLK VPD to VND LSYNC VPD to VND FSYNC VPD to VND DATA VPD to VND RESET_B VPD to VND 10% to 90% in 10nS	 Master Clock Line Sync Frame Sync (Integ. Control) Mode Control Master Reset (optional) → 4 feedthroughs + 1 optional (RESET_B)
Outputs	Selectable 1, 2 or 4 with Reference Output	Default = 1 outputs → 4 feedthroughs + 1 optional reference

- **Minimum of 15 feedthroughs (4 outputs) + 3 optional VREF, RESET_B, OUTR**
- **Minimum of 12 feedthroughs (1 output) + 3 optional VREF, RESET_B, OUTR**

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Power	No reference output @ Max Tint @ Min Tint ≤ 35 mW ≤ 45 mW 1 Output ≤ 45 mW ≤ 54 mW 2 Outputs ≤ 62 mW ≤ 71 mW 4 Outputs	Estimated Values @ Max Tint @ Min Tint 32mW est 41mW est 41mW est 50mW est 57mW est 66mW est
	With 6 reference columns + one reference output @ Max Tint @ Min Tint ≤41 mW ≤ 50 mW 1 Output ≤ 50 mW ≤ 59 mW 2 Outputs ≤ 67 mW ≤ 77 mW 4 Outputs	Estimated Values @ Max Tint @ Min Tint 37mW est 46mW est 46mW est 55mW est 62mW est 71mW est
Control Register Functions	Programmable Test I/O Anti-blooming control Power Control Master Current Detector Bias Adj. Invert/Revert Windowing (programmable size and position) 1, 2 or 4 Outputs Integration Mode (ITR, IWR, NDRO) Reference Output Enable Global Reset	Default = 1 outputs

Programmable Test	Test Row Input Unit Cell Test Injection VET Circuit	
Detector Bias Adjust	-100mV to 500mV Adjustment @ nominal current (1nA)	7 bit bias control

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Input Current	From 10pA to 0.5nA	Used for simulations Depends on f number and background temperature
Input Charge Handling	≥ 6.5 x10^6 carriers	C_{INT}+C_{SH}=0.578pF at 2V → 7.20x10^6 carriers
Non- Linearity	< ± 0.5%from least squares line fit	Output Voltage vs. Tint Max Dev. from least squares fit over 10% to 80% of full range (unique range for each power setting)
Output Interface	≥ 100k Ohms ≤ 15pF external capacitance	25pF total load capacitance, including bond pad, bonding wire
Output Voltage Swing	2.0V ± 0.2V (Baseline ≈ 1.0V ± 0.1V)	With Defaults: ≈ 1.8V ± 0.2V Typical Output Range at 300k ≈ 2V ± 0.2V Typical Output Range at 80K
Noise	Output Noise 200uV Input referred noise 715 e^-_{RMS} Signal-to-Noise Ratio 80dB	Spec values are theoretical plus 10% Without Detector or System Noise

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Column Output Order 1 **Output Mode Output A** **2 Output Mode** **Output A** **Output B**	 Column 0,1,…,639 Column 0,2,…,638 Column 1,3,…,639	 One Output Mode Normal Readout Direction Two Output Mode Normal Readout Direction
4 Output Mode **Output A** **Output B** **Output C** **Output D**	 Column 0,4,…,636 Column 1,5,…,637 Column 2,6,…,638 Column 3,7,…,639	Four Output Mode Normal Readout Direction
Invert / Revert	Reverse Order of Rows and/or Columns	Select using Control Register
Temperature Sensor	0.75V ± 0.05V @ 300K 1.05V ± 0.05V at 77K	Test/Temp Pad Measured values on ISC0403_V1 → 1 additional feedthrough

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ROIC PARAMETER	SPECIFICATION REQUIREMENT	COMMENTS
Full Frame Rate Pixel Rate 12MHz	1 Output ≥ 30 FPS 2 Output ≥ 60 FPS 4 Output ≥ 120 FPS	CLK rate = 6MHz Output rate = 12MHz
Data Valid / Settling Time	Settle to 0.1% @ T=80K in ≤ 55ns Settle to 0.8% @ T=300K in ≤ 55ns	External load capacitance 15pF // 100k□□oad As simulated at room temp.
Adjacent Pixel Crosstalk (ROIC)	< 0.1% @ T=80K < 0.8% @ T=300K	
Non-Adjacent Pixel Crosstalk (ROIC)	< 0.1% @ T=80K < 0.8% @ T=300K	
Minimum Window Size (Max Frame Rate)	4 columns x 4 Rows 8 columns x 4 Rows 16 columns x 4 Rows	1 Output Mode (4.16kF/s) 2 Output Mode (4.16kF/s) 4 Output Mode (4.16kF/s)
Die Size	12.5 mm x 11.43 mm	Layout dimension (to scribe line edge) NOT physical die size Optical center offset Δx=0, Δy=+435um