Pragmatic Semiconductor

Flex-RV: World's First Non-silicon RISC-V Microprocessor

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RISC-V Summit Europe - 2025, Paris, France

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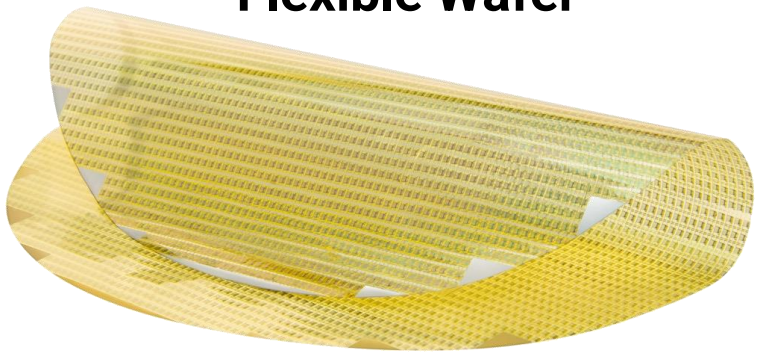
Company & FlexIC Technology

World leader in low-cost “physically” flexible integrated circuits or FlexICs

Flexible Wafer

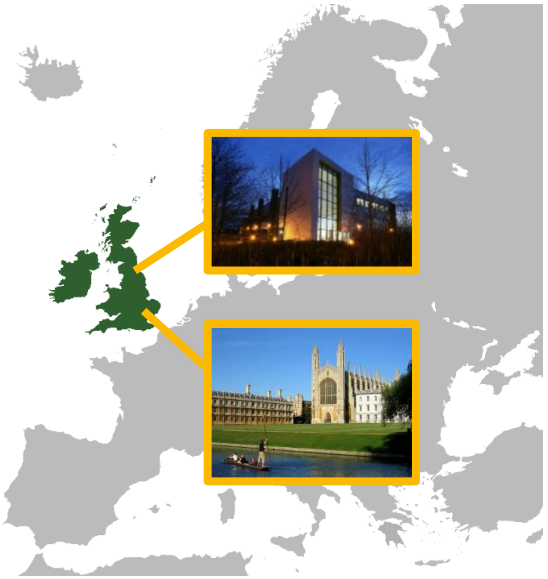


FlexIC

FlexIC Facts

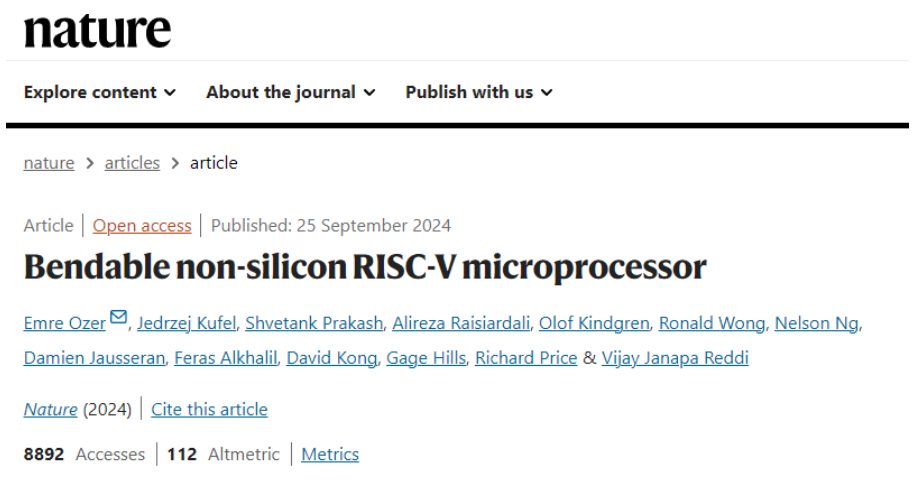
Transistor: Metal-oxide thin-film transistor (TFT)
Semiconductor: IGZO (Indium Gallium Zinc Oxide)
Devices: n-type IGZO TFT, dedicated resistor & MiM capacitor
Substrate: Polyimide with total thickness <30 µm
Process geometry: <=0.8 µm channel length
Logic: Resistive n-type
Fab: Low-cost lithography
Wafer Size: 200/300mm
Supply Voltage: <=3V
Routable metal layers: 4
Memory: ROM & LPROM
Under development: CMOS, EPROM, SRAM/SRAM compiler)

FlexLogic Fab - 1000m² footprint



2010 Founded	Cambridge Durham UK headquarters UK manufacturing
~370 Employees	>$400Mn Investment to date

Flex-RV: Bendable RISC-V Microprocessor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Bendable non-silicon RISC-V microprocessor

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Collaboration

HARVARD UNIVERSITY

qamcom

Milestones

- First non-silicon RISC-V microprocessor
- Integrated ML capability
- Assembled onto a FlexPCB
- Demonstration of functionality while physically flexed

Motivation: Extreme Edge Applications

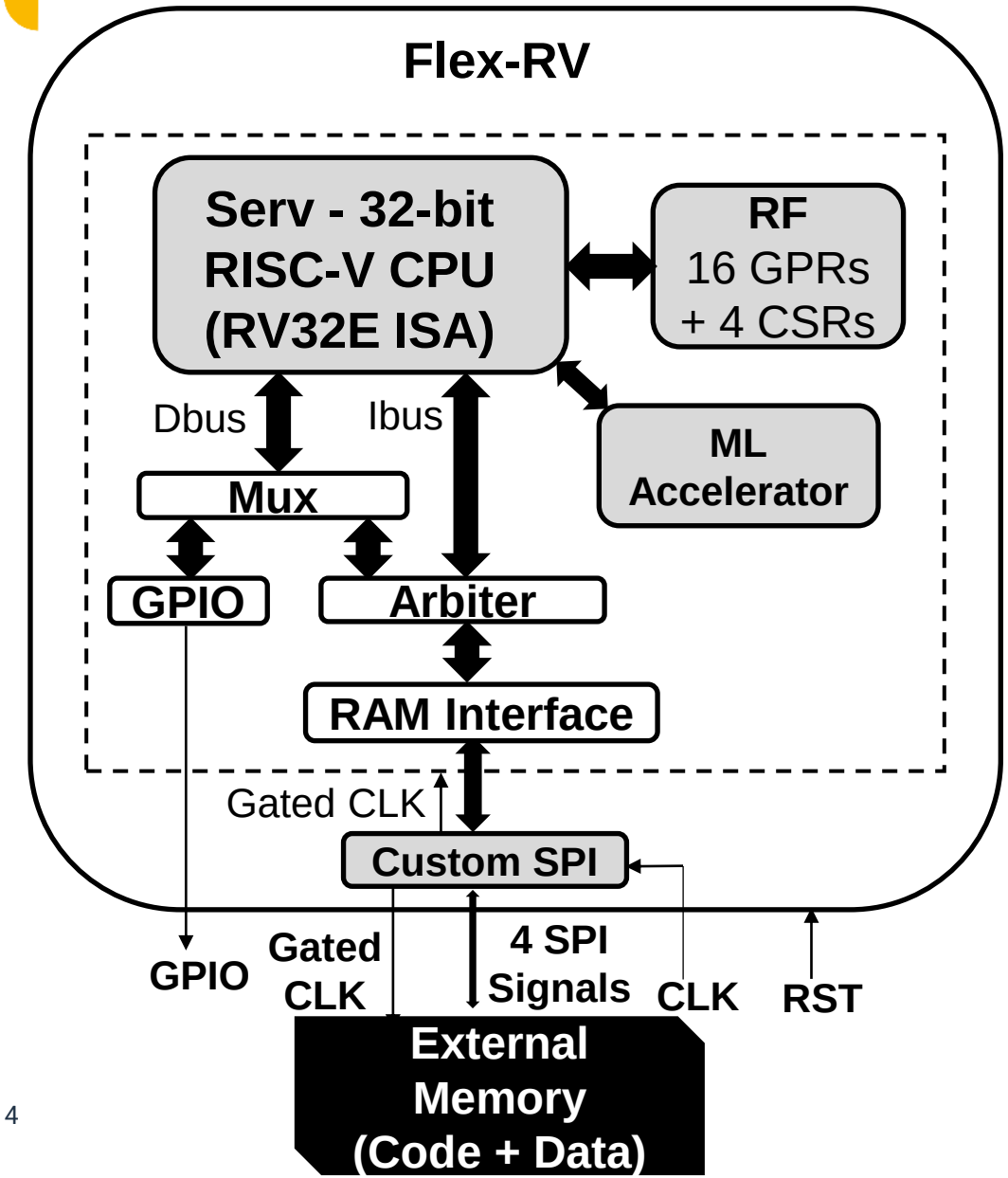
Fast Moving Consumer Goods (FMCG)

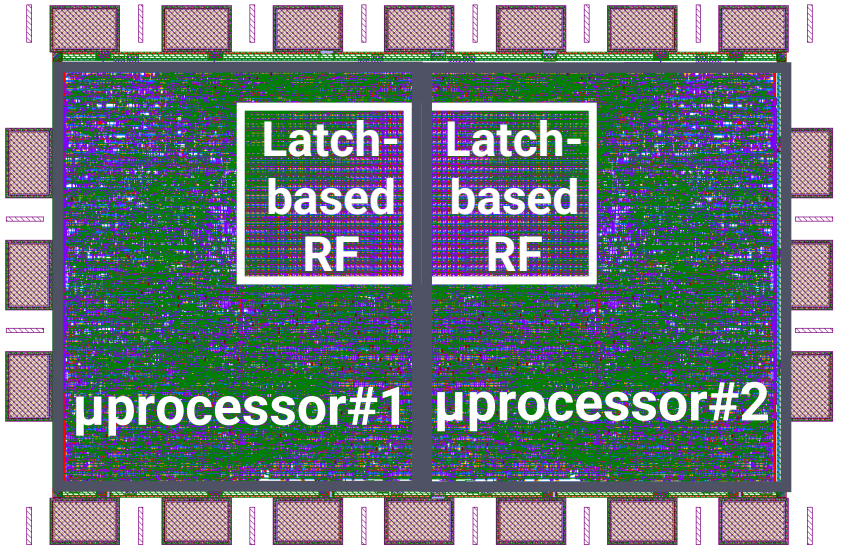
Healthcare

E-Textile

Agrotech

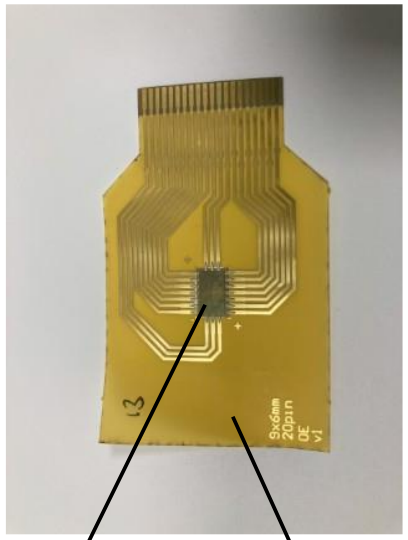
Flex-RV Design & Implementation

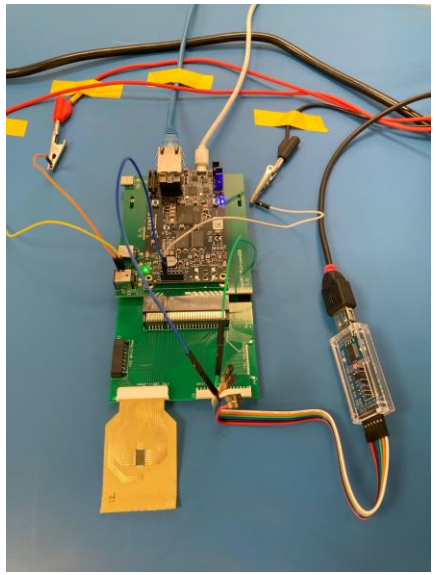


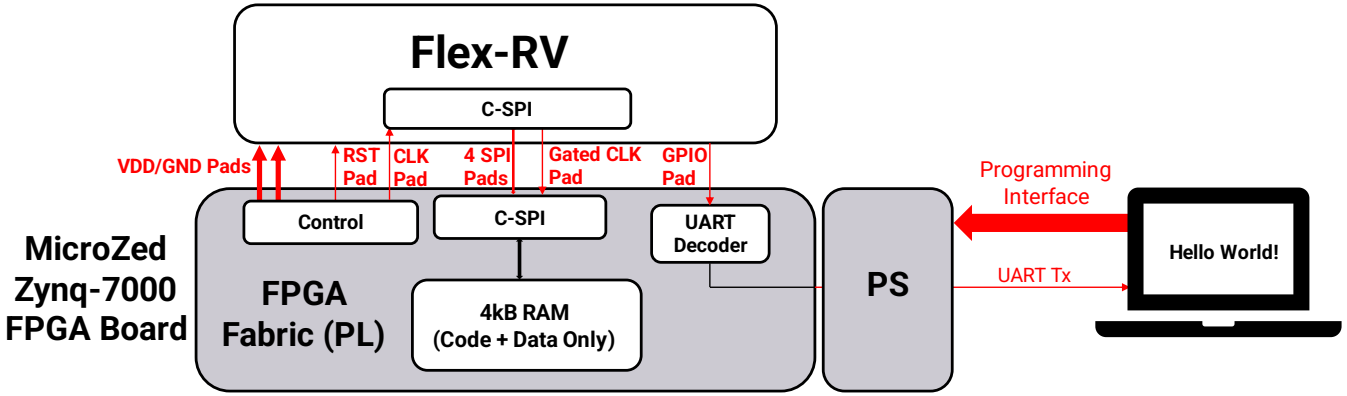


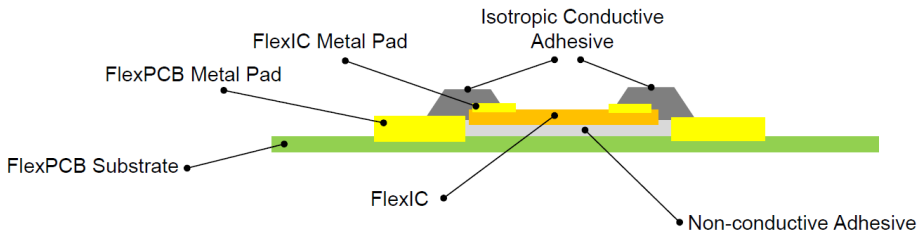
Technology	0.6 µm resistive n-type FlexIC
Area	17.49 mm² per Flex-RV microprocessor
Gatecount	12,596 NAND2-equivalent per Flex-RV microprocessor
Implementation Clock Frequency	61 kHz
Power	5.79 mW @3V per Flex-RV microprocessor

Assembly of Flex-RV onto a FlexPCB and Tests

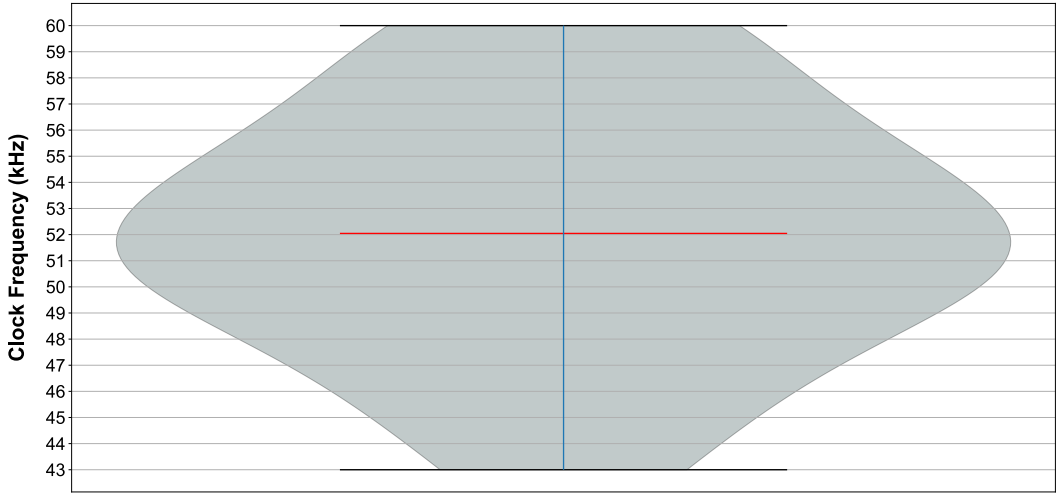








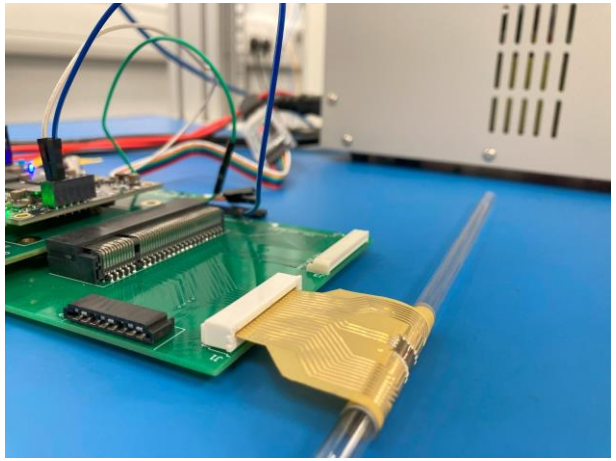
Over-Edge Printing



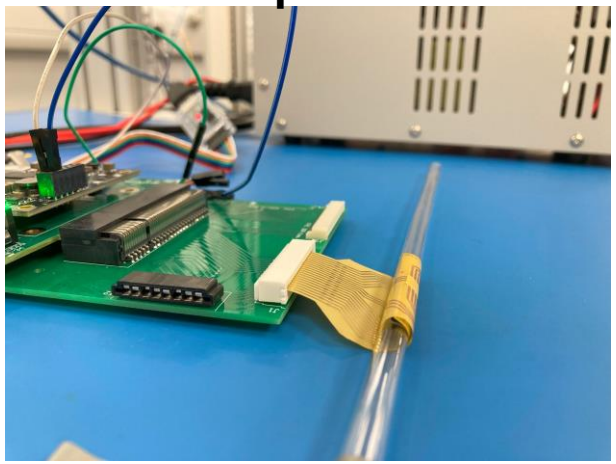
Average: 52kHz
Max: 60kHz

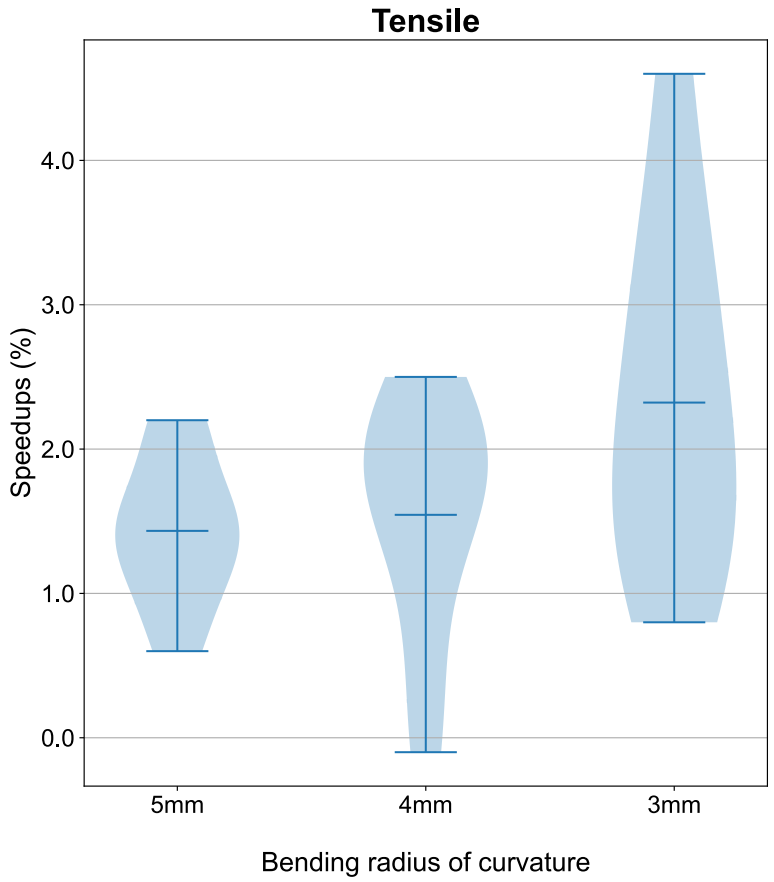
Bending Tests

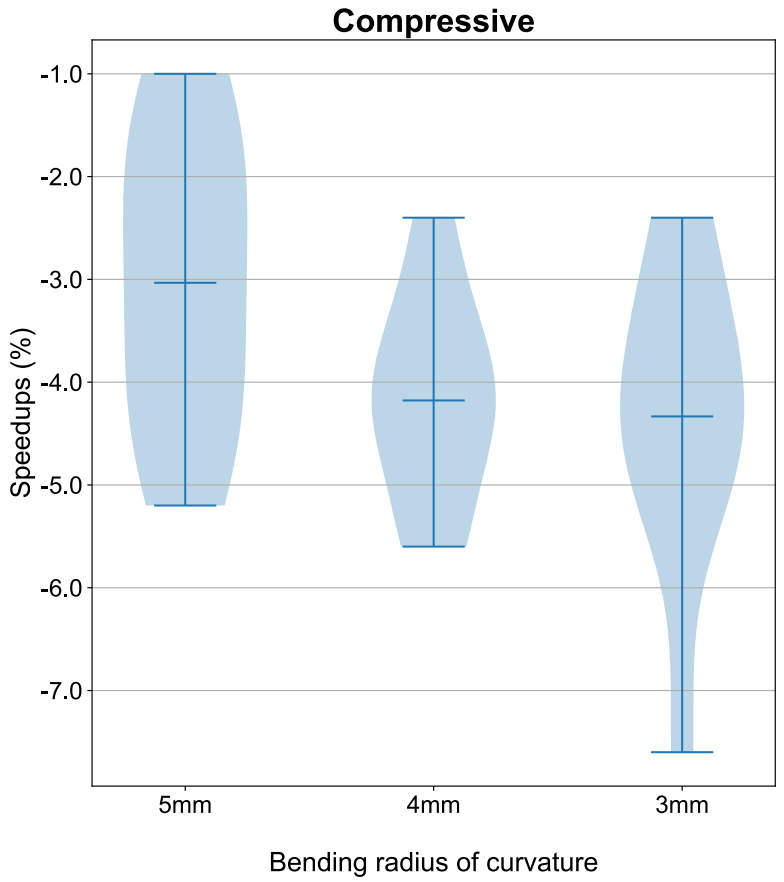
Tensile



Compressive







Flex-RV Demo Video

Flex-RV is the first programmable and physically flexible general-purpose RISC-V microprocessor, featuring machine learning capabilities, and demonstrated to bend below a 5mm radius of curvature whilst still executing programs, all for less than a dollar.

Conclusion

First **non-silicon RISC-V processor** and can run arbitrary compiled programs written in high-level languages (e.g., C)

Integrated programmable ML accelerator with custom RISC-V instructions support to accelerate ML applications

Demonstration of functionality and dynamic bendability of **the assembled system (i.e., Flex-RV on Flex-PCB)**

Questions?

Contact: eozer@pragmaticsemi.com