

Energy Harvesting IC for Illuminating Sights

Douglas Cox and John Ambrose

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by Douglas Cox

info@mix-sig.com



Mixed Signal Integration

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2157-50 O'Toole Avenue

San Jose, CA 95131

+1 408-434-6305

www.mix-sig.com

What is Energy Harvesting?

- Vibration detection
 - Using transducer
 - Piezoelectric device
- RF energy
- Magnetic/Hall Effect



Power Capabilities

- Maximum Voltage output 4 VDC
 - Internal Protection
 - Prevents damage to Silicon
- Typical current: $200\mu\text{A}$
 - Limited by Input Source
 - Piezo wafers have greatest output

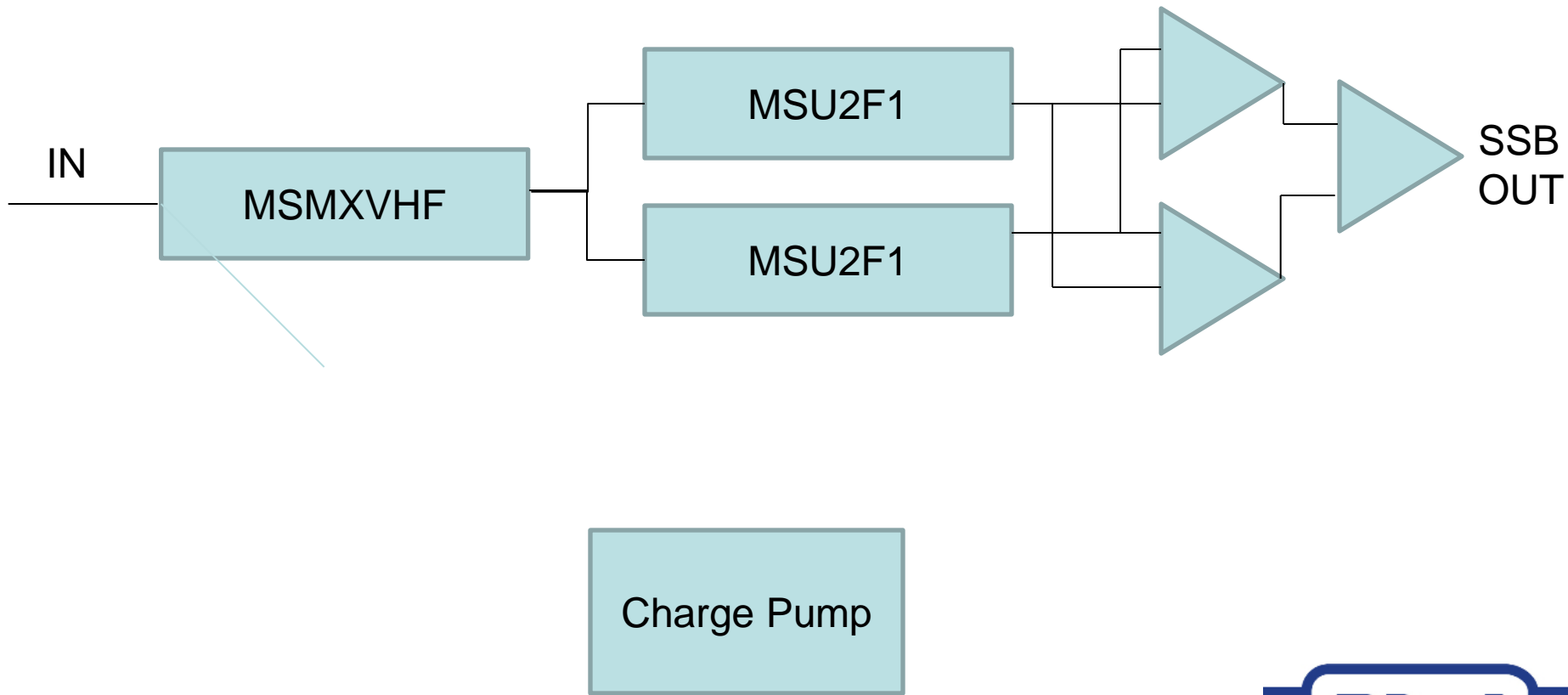


Analog Signal Processing Functional Capabilities

- Filters
- Op Amps/Comparators
- Multiplexors
- Data Converters
- Limiter/Companers
- Phase Locked Loop
- Analog Front End



Signal Processing Example

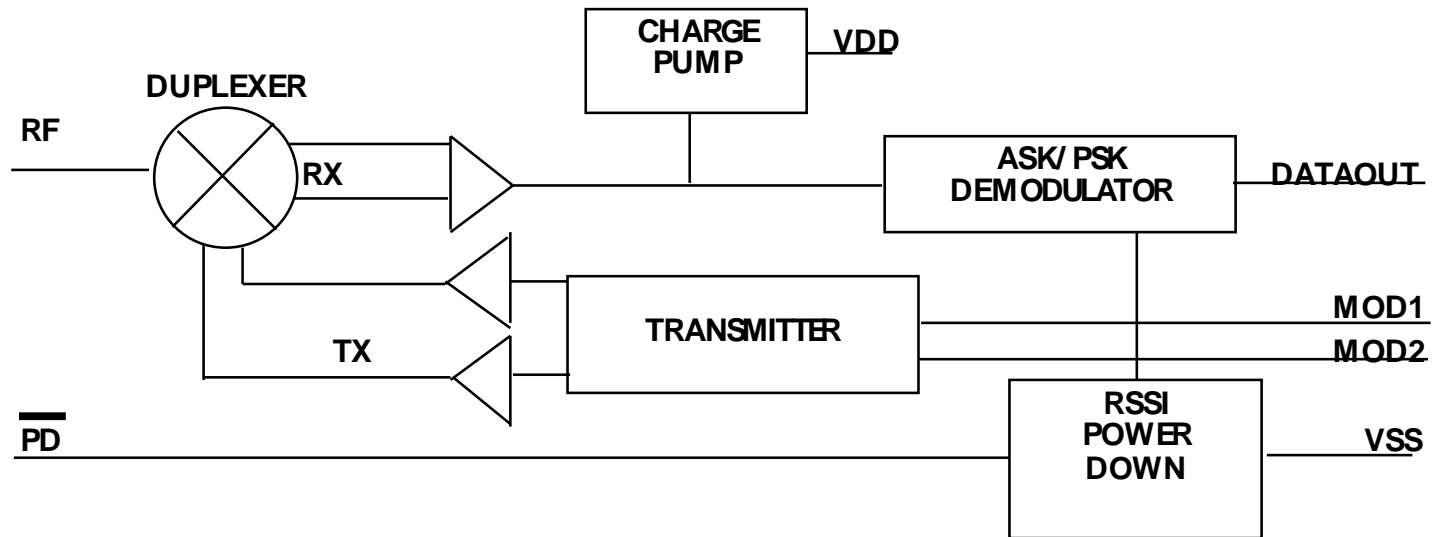


Applications

- Powering laser sights
- Illuminating red-dot sights
- Short range communications
- Remote programming



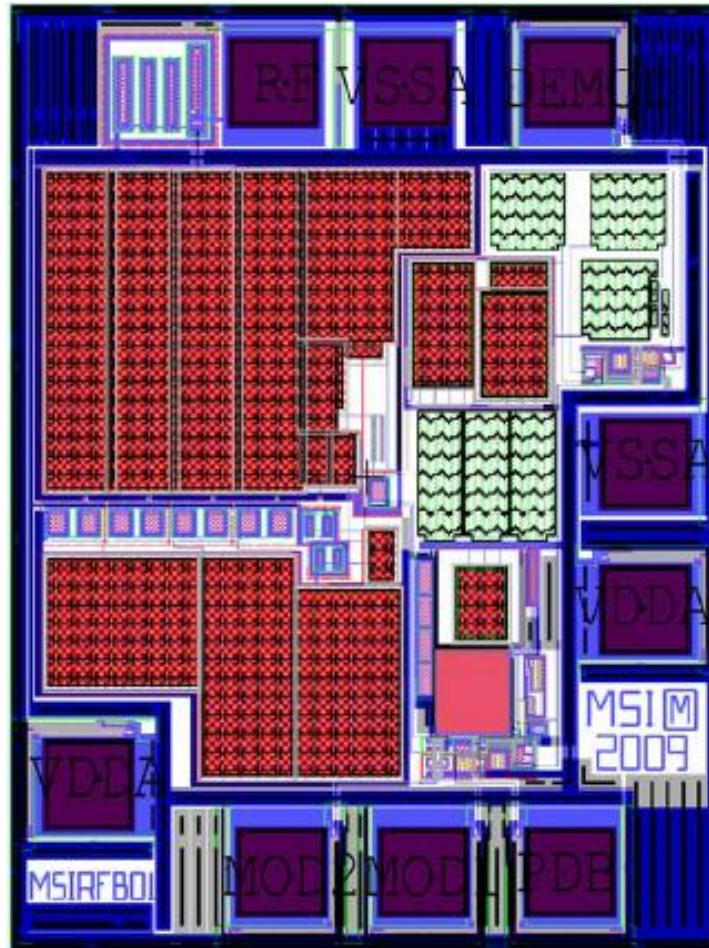
MSRFIF Block Diagram



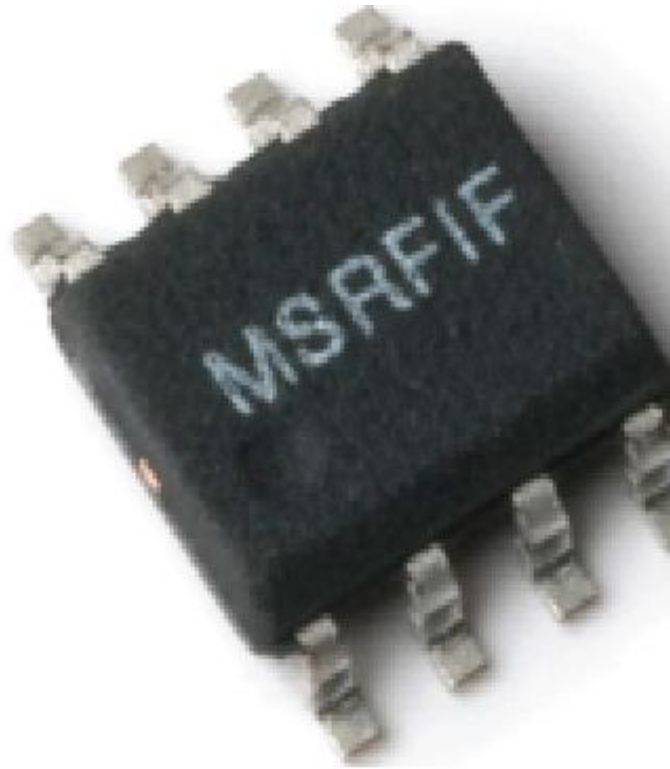
Radio Frequency Interface Integrated Circuit



MSRFIF Die Plot



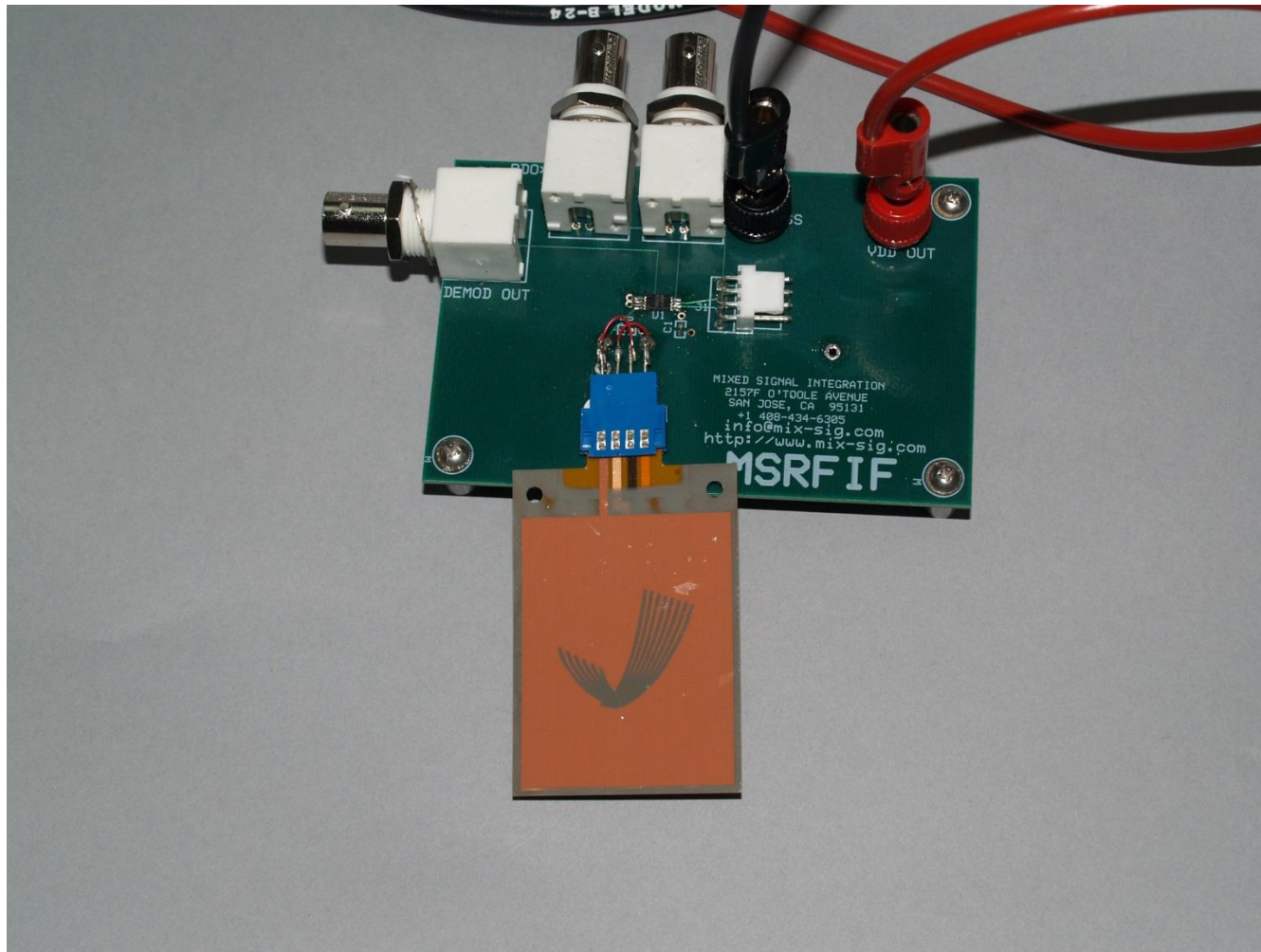
MSRFIF Package Options



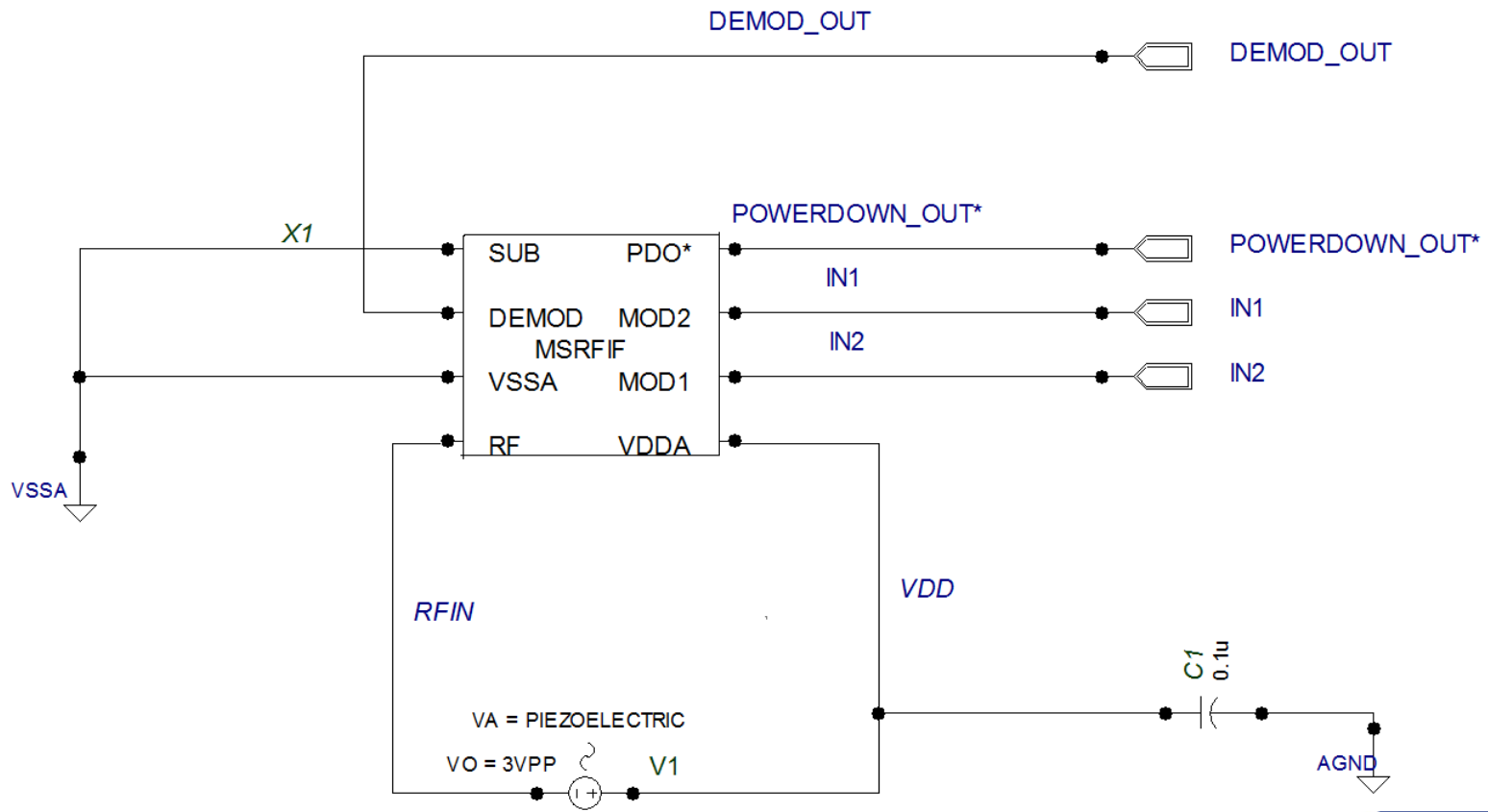
Radio Frequency Interface Integrated Circuit



Energy Harvesting Application Board



Application Schematic



Red Dot Rifle Sight



Bench Evaluation Data

- Piezoelectric wafer is tuned
- Voltage generated by Motion fed to charge pump of MSRFIF.
- VDD out is 2.5V at 200 μ A
- Adjust capacitor to increase on-time



Other Potential Uses

- Remote Programming
 - Safe and Arm time
 - Fuzing
- Bluetooth™



Remote Programming Example



Technical Challenges

- Piezo efficiency
 - Amount of motion limited for application
- Piezo size
 - Need larger size for voltage/current needs
- Charge pump efficiency
 - Optimized for RF
- Antenna size
- Capacitor size



Summary

- MSRFIF provides:
 - Charge pump for power
 - Perfect for high efficiency LEDs
 - Communications Channel
- Piezo wafer generates energy
- Potential to achieve higher current and more functions in future designs





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