Implantable Stimulator for Telemetric Operation

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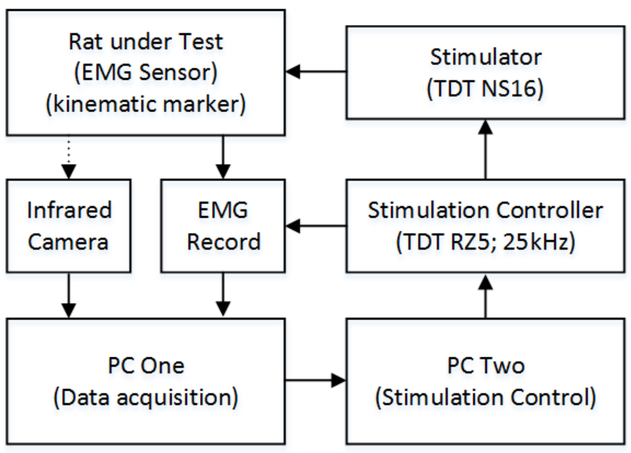
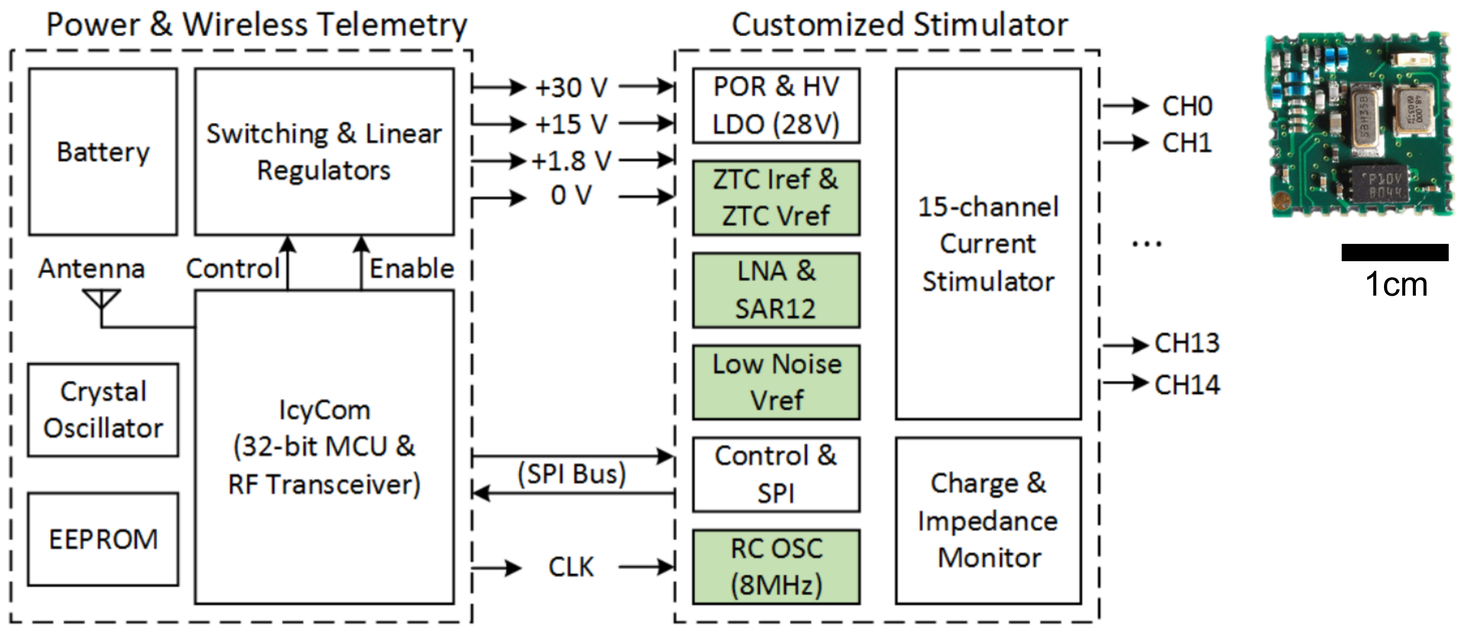
Conventional Solution

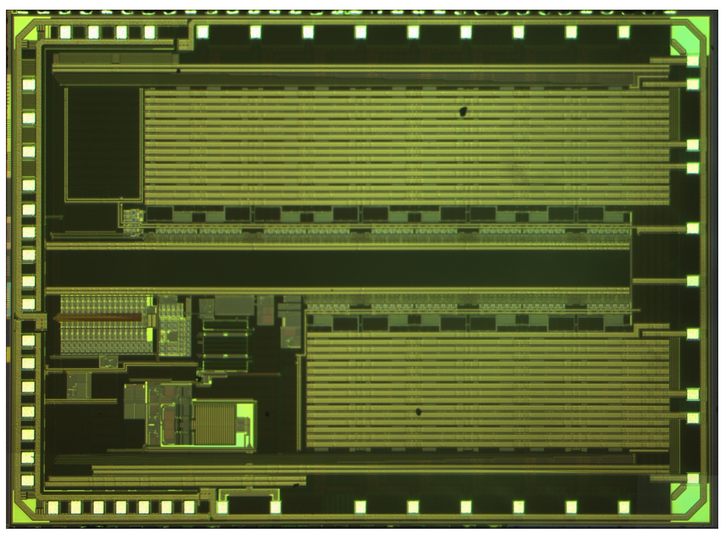


Dimensions up to 0.5m

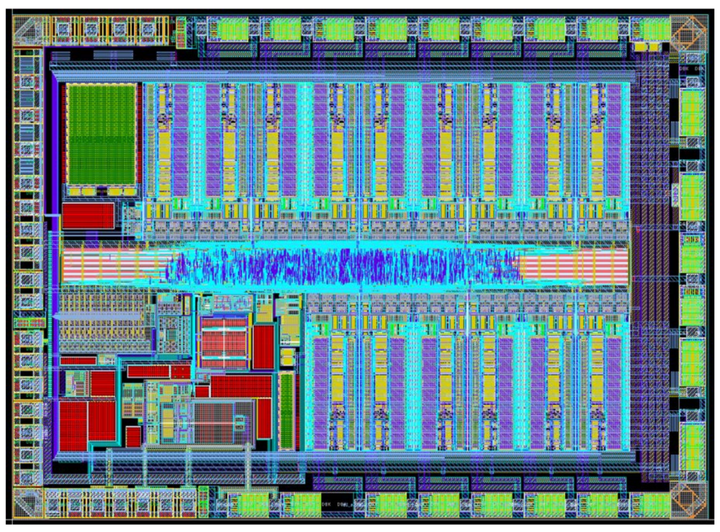
Implemented System



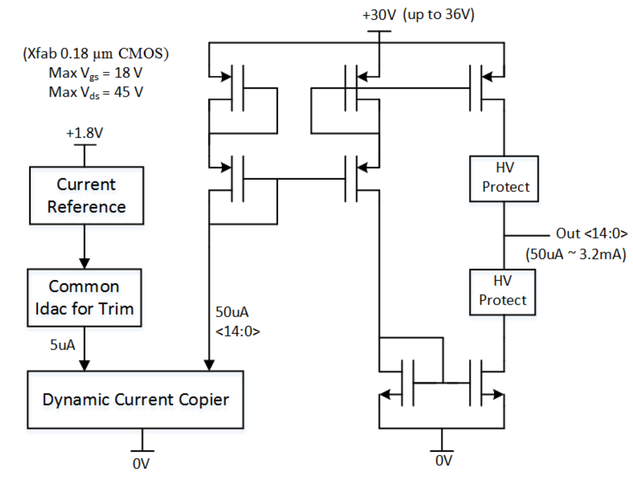
Micrograph



Layout View



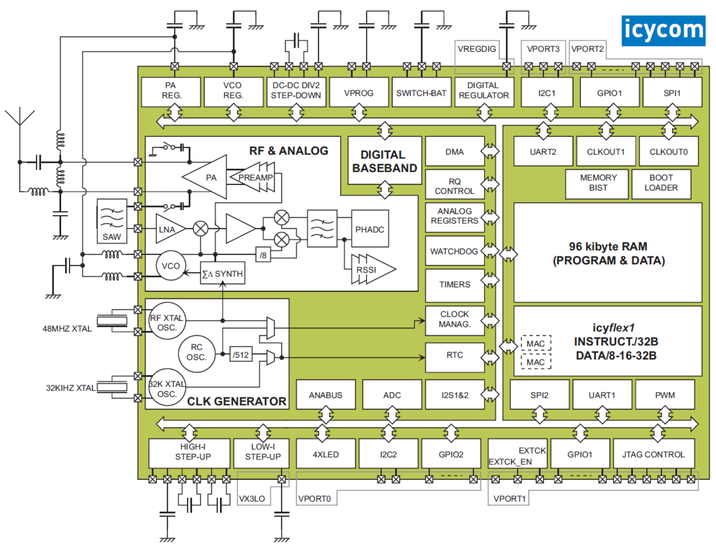
Customized Stimulator



Key Features

- 15 current-stimulation channels
- Maximum compliance-voltage of 30 V
- Maximum current amplitude of 3.2 mA
- High current accuracy of +/- 5 µA
- Low standby current of 10 µA

Embedded Telemetry



- 400 kb/s RF radio
- 32-bit dual-MAC DSP core
- Low power consumption

Comparison to work of others

Items	[1]	[2]	This Work
Year	JSSC; 2012/01	CICC; 2014/09	2014/06 (fabrication)
Channels	256	16	15
Voltage	20 V	15 V	30 V
Full-scale	1.0 mA	4mA (8 CH ON)	3.15 mA
Resolution	5-bit in 4 ranges	8-bit	6-bit
Max INL	Not Available	+1.79/−0.85LSB	±0.03 LSB
Settling Time	Not Available	5.8 µs	0.3 µs
Undershoot	No	Yes	No
HCI Degradation	Yes	Not Available	No
Charge Balancing	Active (CMP based)	DC blocking capacitor (2 µF)	Active (ADC based)

Conclusions

- 15-channel CMOS neuronal stimulation system has been designed, implemented and fabricated.
- Use of CMOS technology obliviates need for external instrumentation.
- Low noise neuronal recording amplifier together with 12-bit SAR ADC has been implemented.

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