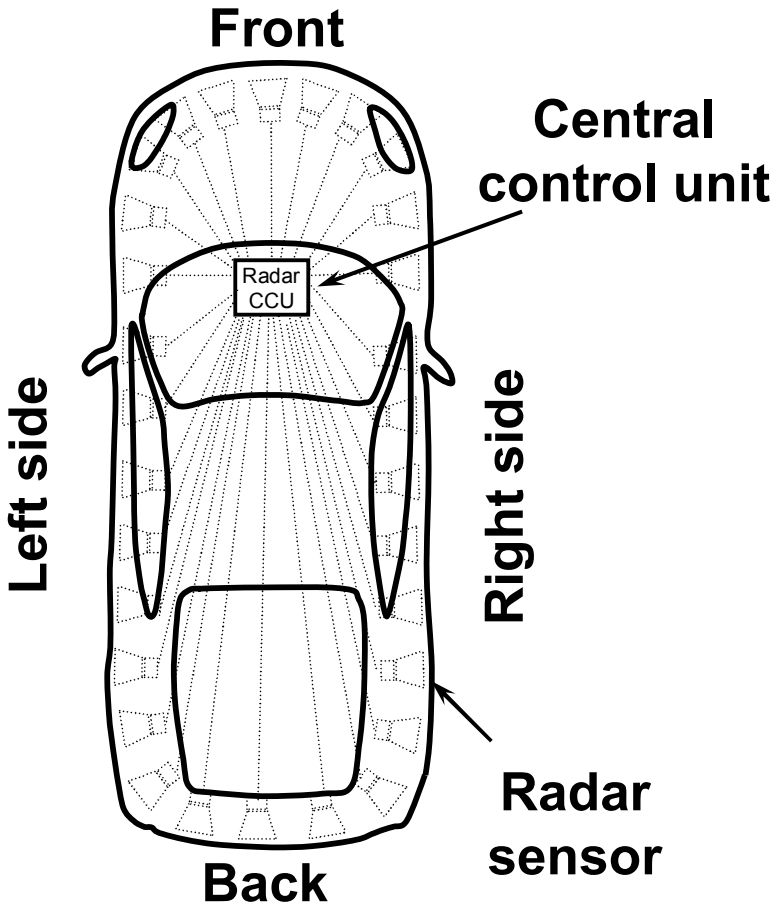
22-29GHz Ultra-Wideband CMOS Pulse Generator for Collision Avoidance Short Range Vehicular Radar Sensors

Ahmet Oncu, B.B.M. Wasanthamala Badalawa, Tong Wang and Minoru FUJISHIMA

School of Frontier Sciences
The University of Tokyo

Introduction



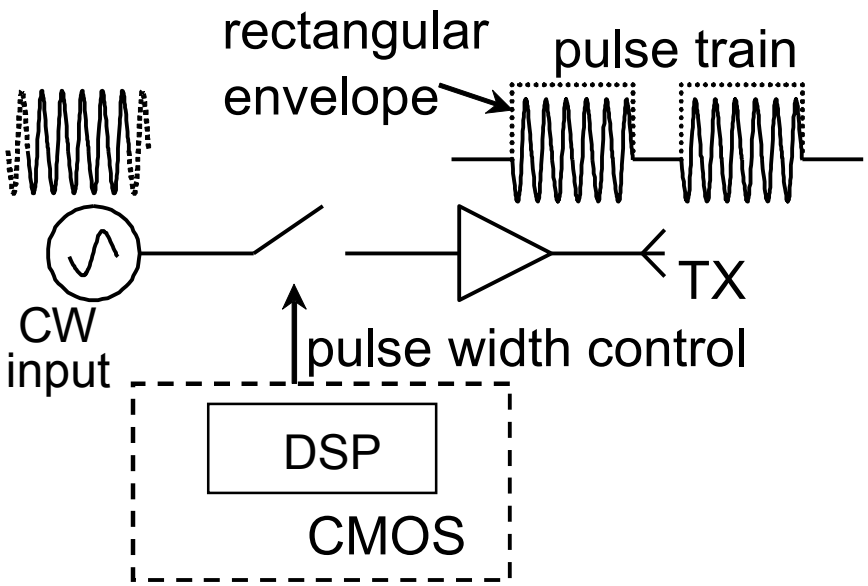
Short range radar sensor system covering 360°

- 360° pre-crash detection
- Collision warning
- Blind spot detection
- Intersection alerts
- Automatic cruse control
- Park aid
- …..

- A few cm resolution
- At least 5GHz Bandwidth
- Low power
- Low cost

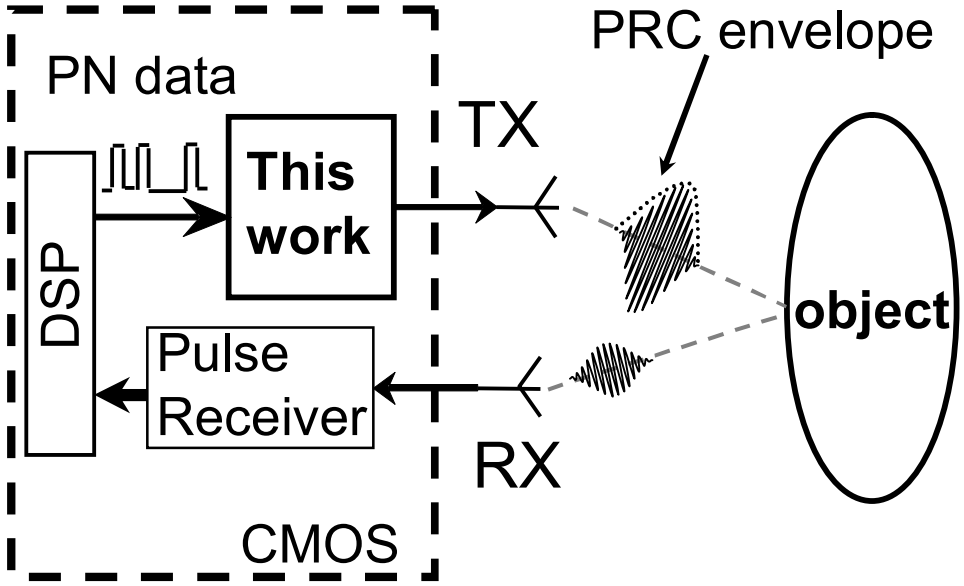
Proposed CMOS SR radar sensor

Conventional transmitter for SR pulse radar sensor



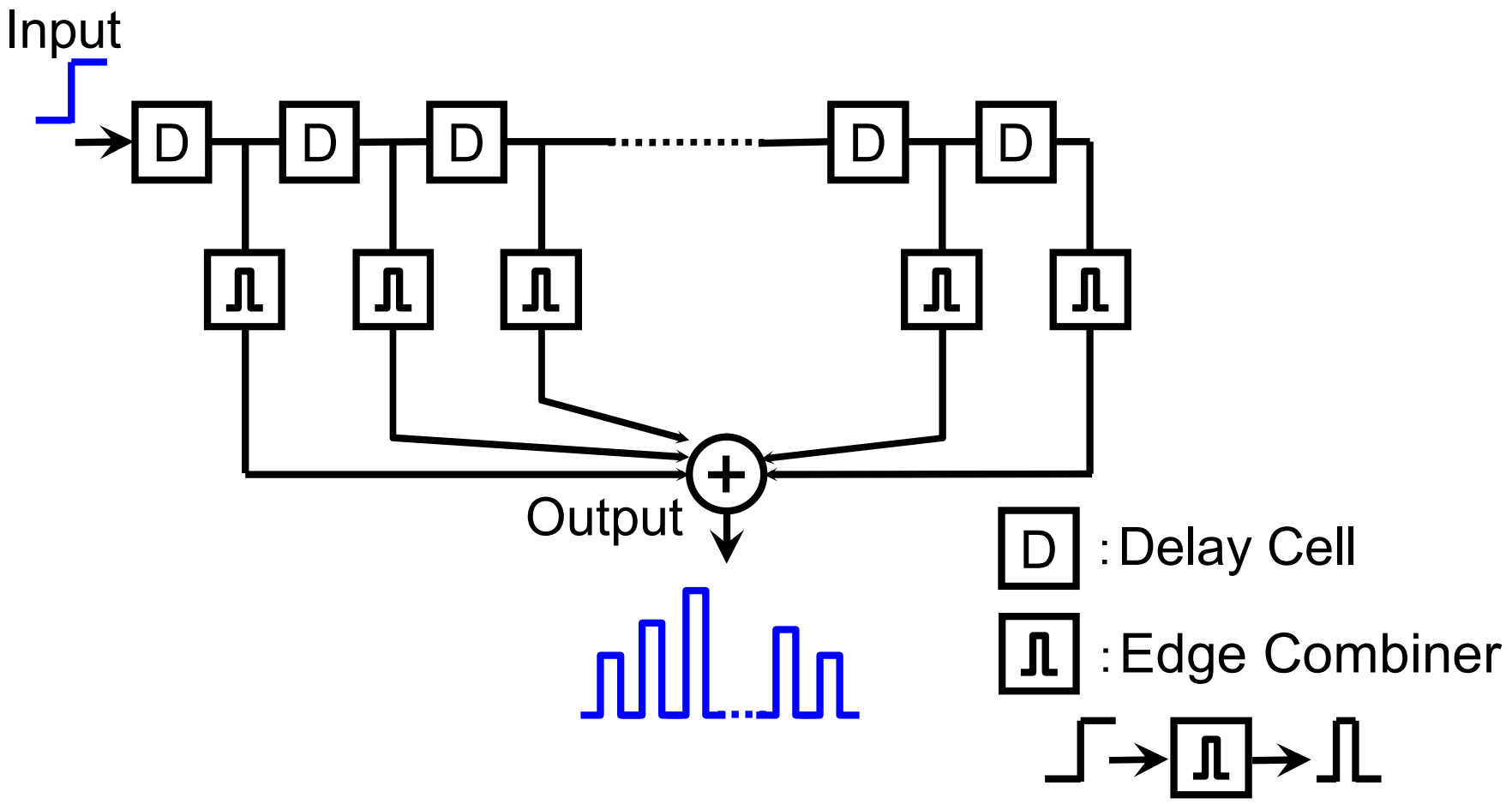
- Many discrete components
- mmWave CW oscillator ON
- High power consumption

Proposed CMOS SR pulse radar sensor

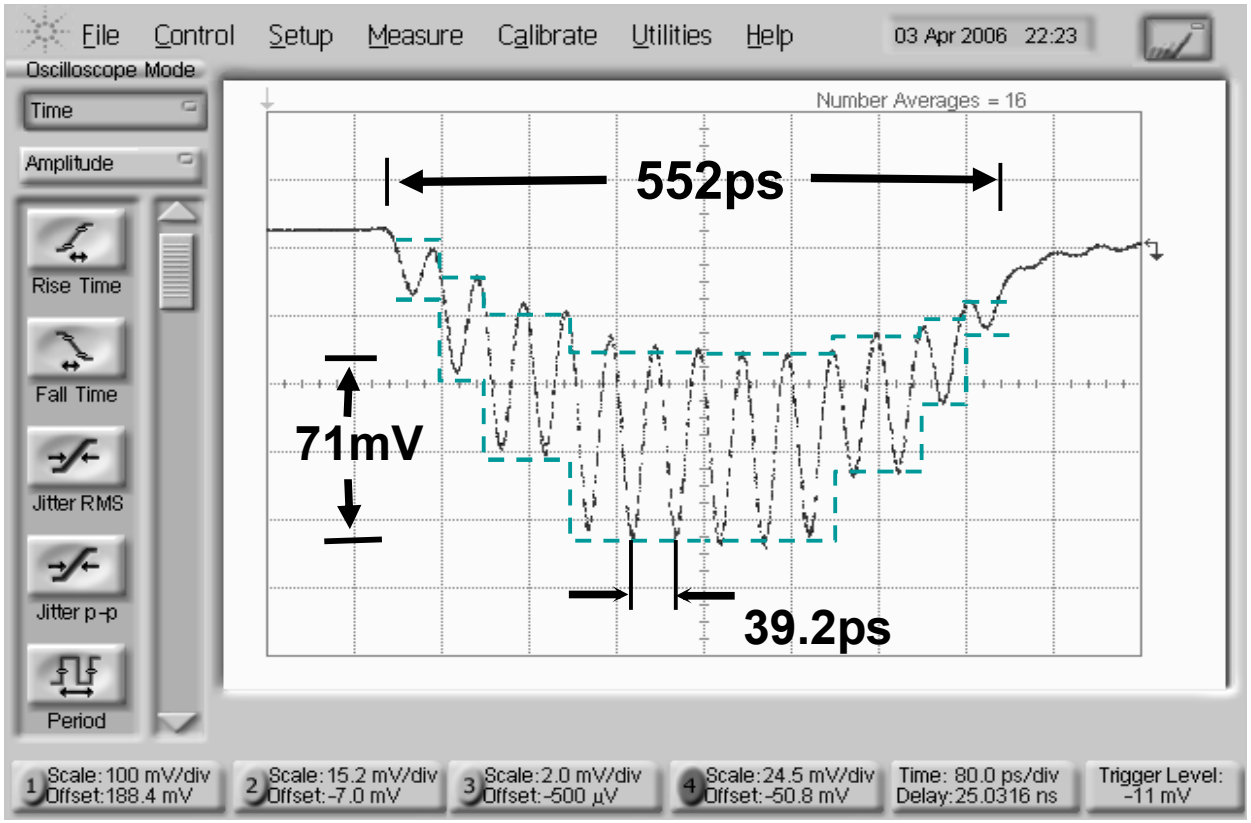


- Less discrete components
- No mmWave CW oscillator
- Low power consumption

Pulse generator block diagram



Time domain measurement



V_{RFpp}=71mV

P_{RFpeak}=-19dBm

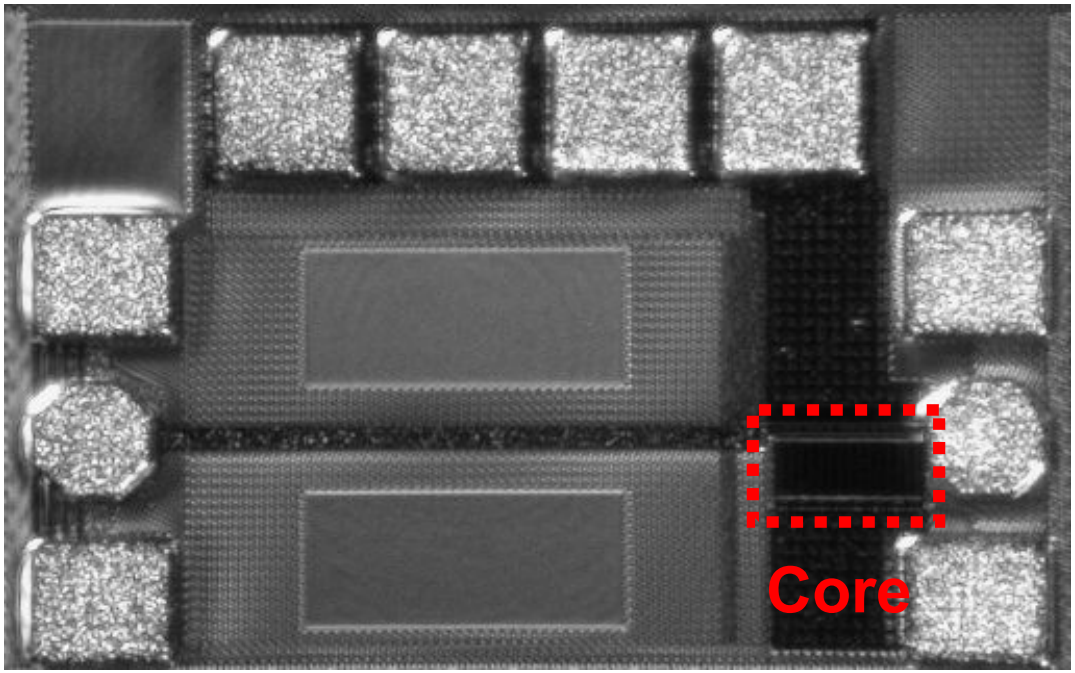
Subtracting connection loss (4.6dB)

V_{RFpp}=120mV

FCC specification
P_{out}= –41.3dBm/MHz
P_{inst}= 0dBm

Required PA gain
G= 14 ~ 19dB

Chip summary



Chip summary

Technology	90nm CMOS
Band	22-29GHz
Modulation	OOK
Supply Voltage	0.91V
Max Data Rate	1 Gbps
Power Consumption	1.4 mW
Core Size	90μm × 15μm

Conclusion

- Pseudo mmWave UWB CMOS pulse generator for short range automotive radar application is demonstrated.
- Up to 1Gbps input data rate, 7GHz wide and 552ps shot pulses with -14dBm output power are generated.
- 3.19 μW static power dissipation and 1.4pJ/bit which is 100 times less than reported pulse generators.
- With its simple structure it will open up new application for short range collision avoidance automotive radars with low power consumption and low cost.