

SAND MicroSystems

Innovation with Sand

The Electronics behind LiDAR and its Miniaturization

EPIC Online Technology Meeting on ADAS and Autonomous Driving

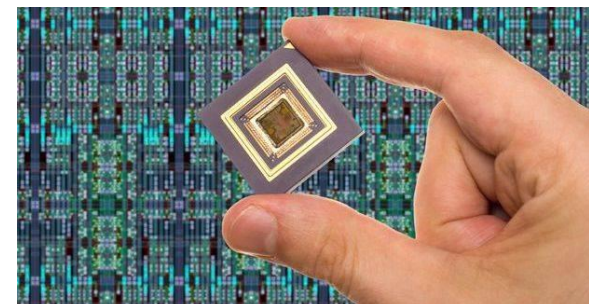
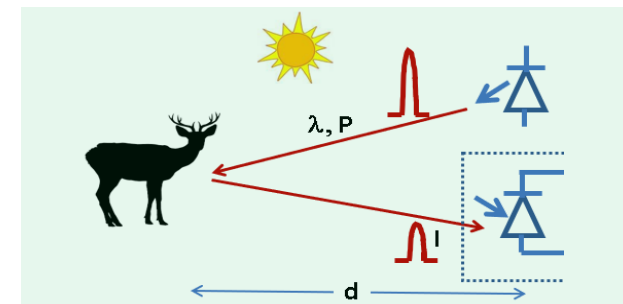
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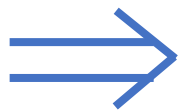


SAND MicroSystems

SAND MicroSystems is a Consulting and Service Company providing solutions, together with partners, to develop and to improve performance of LiDAR products (ToF, FMCW) by:

- **Architecture**
- **Front-end Electronics**
- **Miniaturization (ASIC integration, Co-Packaging)**

We help to think already from the early stages about the miniaturization of LiDAR.



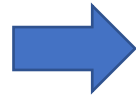
High-end LiDAR Architectures can be selected already at the beginning!



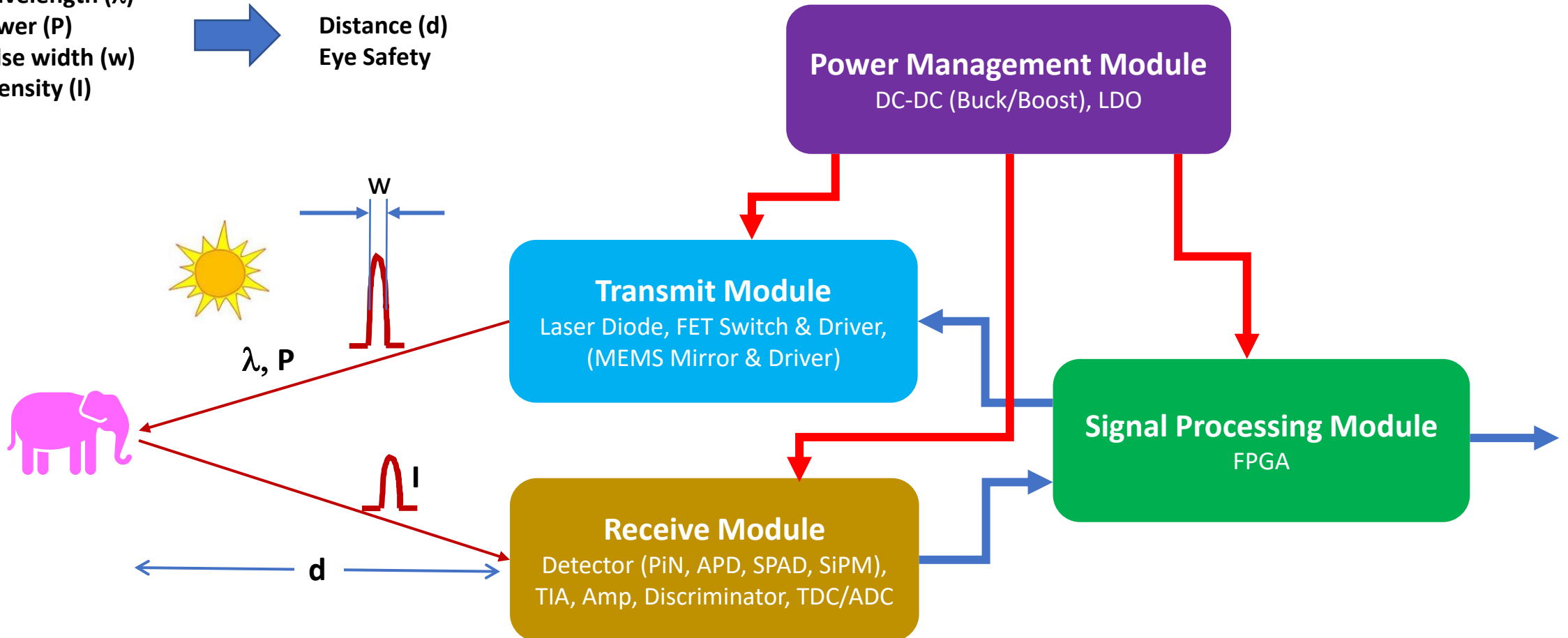
The 4 Key Electronic Modules of LiDAR

Parameters:

Wavelength (λ)
Power (P)
Pulse width (w)
Intensity (I)



Distance (d)
Eye Safety

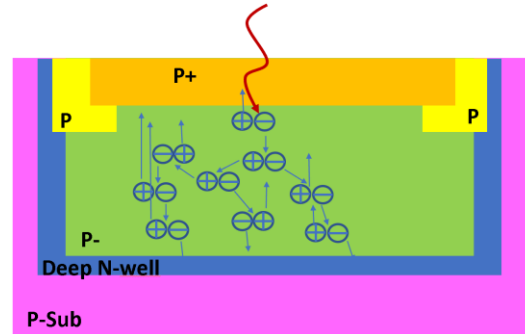




Receive Module

Detectors

- PiN (gain ≈ 1)
- APD (gain ≈ 100)
- SPAD (gain $\approx 1'000'000$)
- SiPM (quasi Analog output)



Challenges: Noise, DCR, PDE, photonic noise, responsivity, Optical crosstalk, after pulsing, DR, linearity

Discriminator

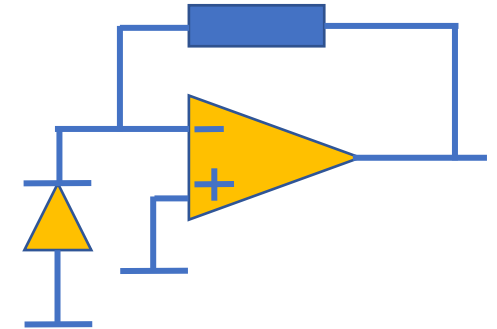
- Constant Fraction Discriminator (CFD)
- Leading Edge Discriminator (LED)
- High-pass Timing Discriminator

Challenges: wrong decisions



Front-end Amplifier

- TIA
- Voltage Amplifier

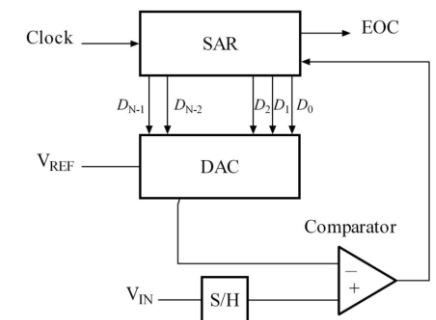


Challenges: Input referred noise, stability, minimum and maximum range

TDC / ADC

- Integrated ADC (SAR)
- Off-the shelf ADCs
- TDC (Time to Digital Converter)

Challenges: Area, Power consumption, speed





Transmit Module

Laser Diode

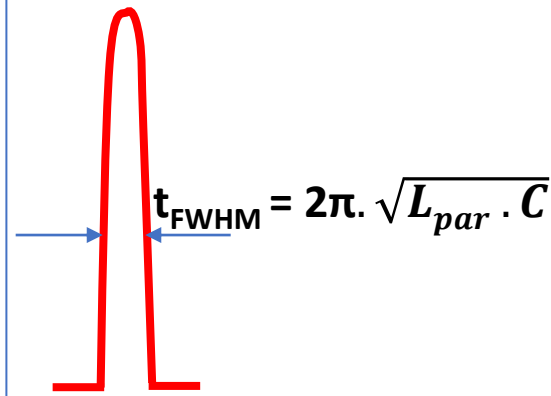
- Pulse lasers (like EEL)
- Tunable Lasers (control)

Challenges: heat, wavelength, pulse width, high currents, parasitics, line width

FET Switch Driver

- Discrete components (off-the-shelf)
- ASIC

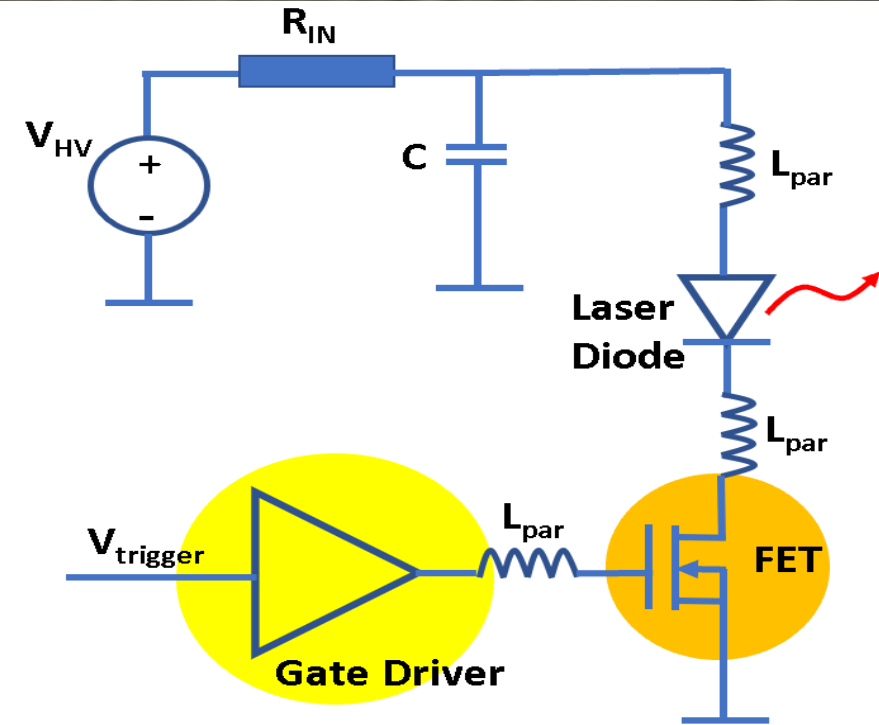
Challenges: Size (limited number in a package)



FET Switch

- JFET
- MOS FET
- GaN FET

Challenges: High switching currents, heat, parasitics





Power Management Module

High Voltage Supplies

- DC-DC

Mid Voltage Supplies

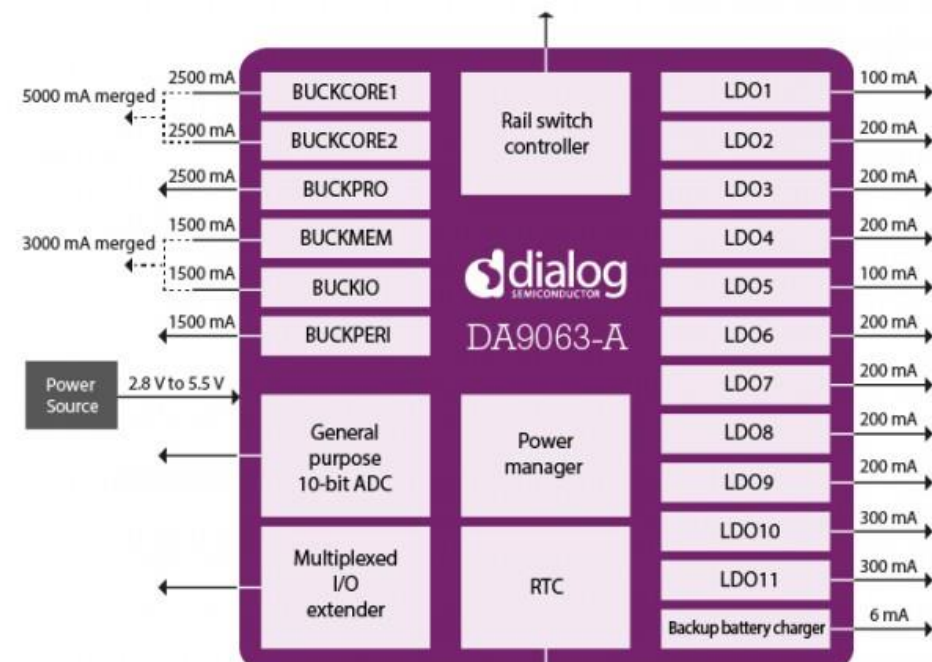
- LDO
- DC-DC

Low Voltage Supplies

- LDO

High Current Supplies

- DC-DC

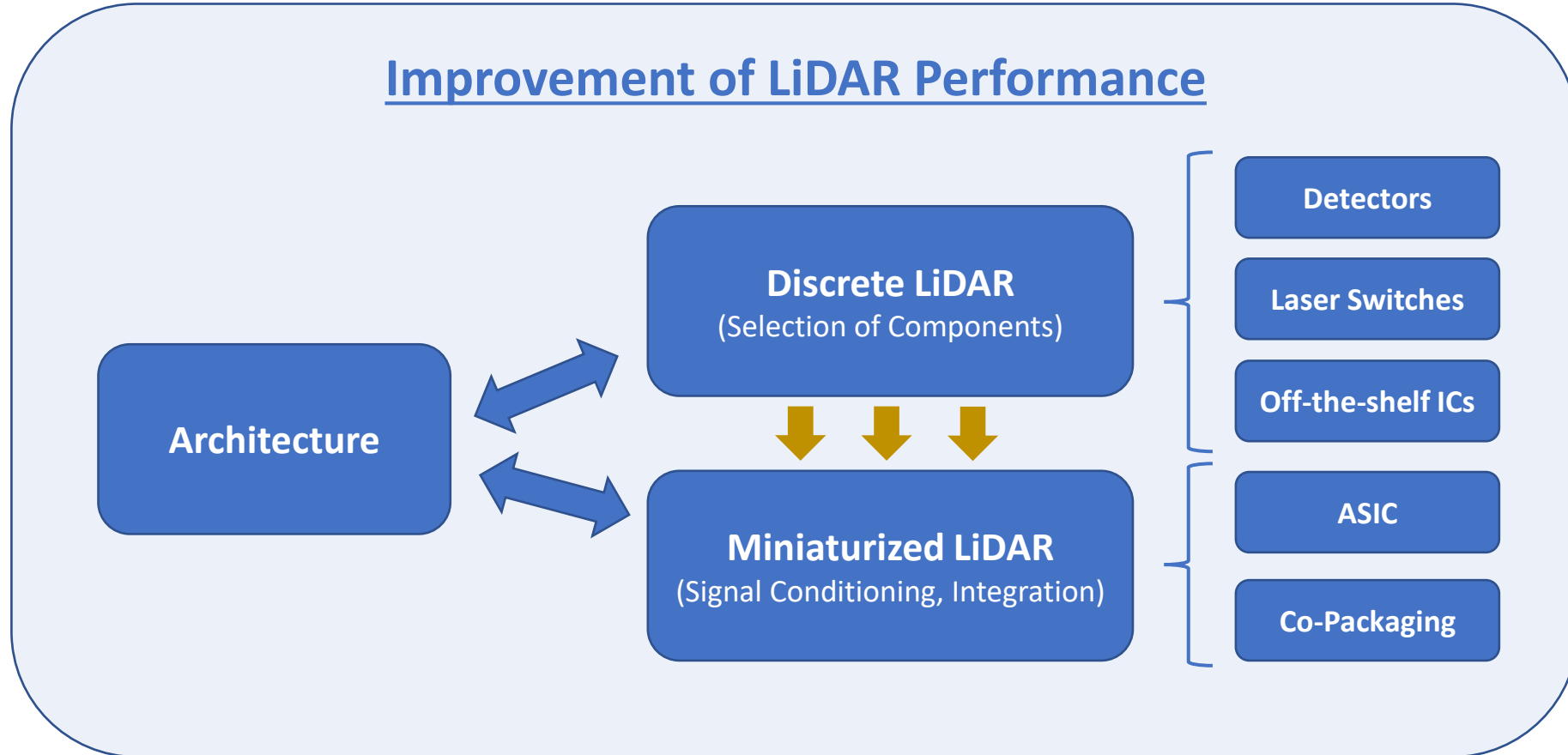


A typical off-the-shelf component from Dialog but they may not contain everything that we need for a specific LiDAR system.

A Dedicated Power Supply Management Strategy Needs to be Developed for Each System!



SAND MicroSystems' Solutions





What we offer?

What are we looking for?

Offering special solutions to improve the LiDAR performance by miniaturization and proposal of corresponding architectures.

Looking for cooperations with companies developing new LiDARs and Companies with different expertise in LiDAR domain for partnerships.



Thank You!