

HOTSiC



ROYAL INSTITUTE
OF TECHNOLOGY

High temperature power
electronic systems with SiC IC

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Swedish Foundation for Strategic Research
24,2 MSEK for 5 years (2011-2016)

<http://http://www.stratresearch.se/en/>

“to boldly go where no electronics has gone before”

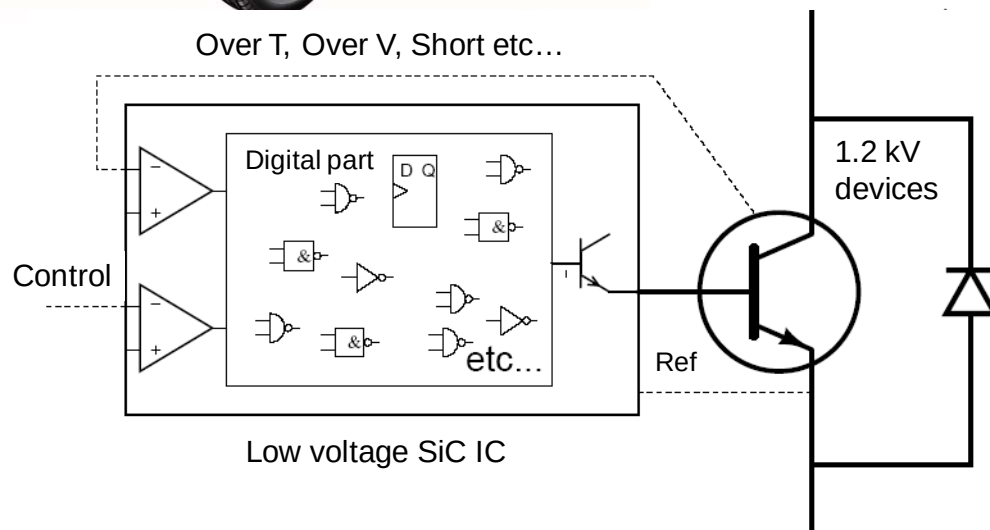
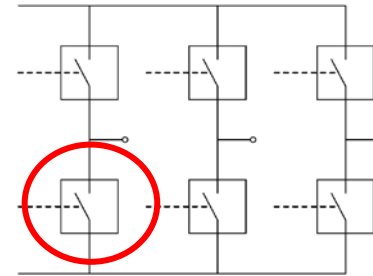
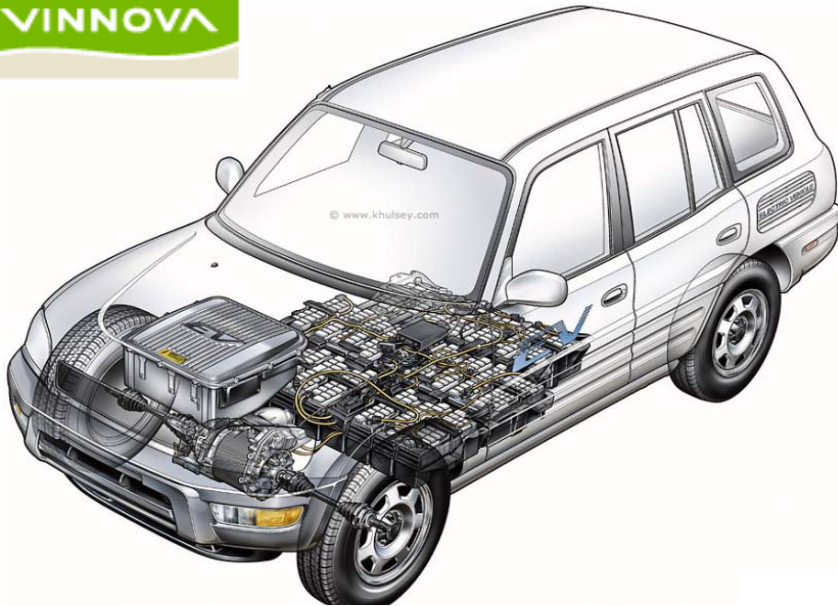
- Demonstrating electronic systems at 600 °C using Silicon Carbide integrated circuits, with radiation hardness.
- A golden opportunity for electronics at much higher temperatures in entirely new system applications.
- KTH experience since 1992 in the field of SiC devices.
- Two demonstrators to be built.

Applications for harsh environments

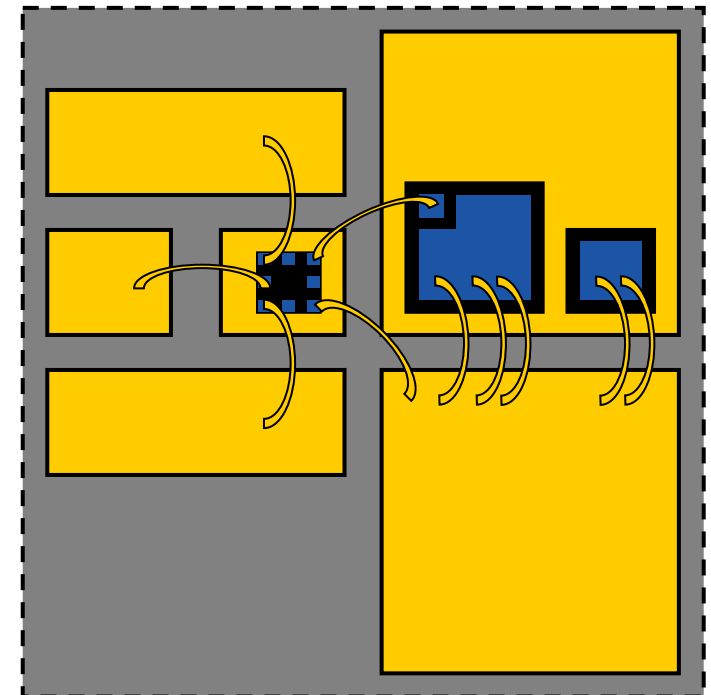
Application	Type	Temperature	Radiation
Oil and gas drilling	P, S	600 °C	No
Industrial motor drives	P	300 °C	No
Automotive	P, S	300-600 °C	No
Aviation	P, S	300-600 °C	(Yes)
Space exploration	S	600 °C	Yes
Nuclear energy	(P) S	300-600 °C	Yes

P = Power switching applications
S = Sensor signal processing

Previous project finishing 2011: High temperature electronic systems all in silicon carbide (SiC) for electric vehicles

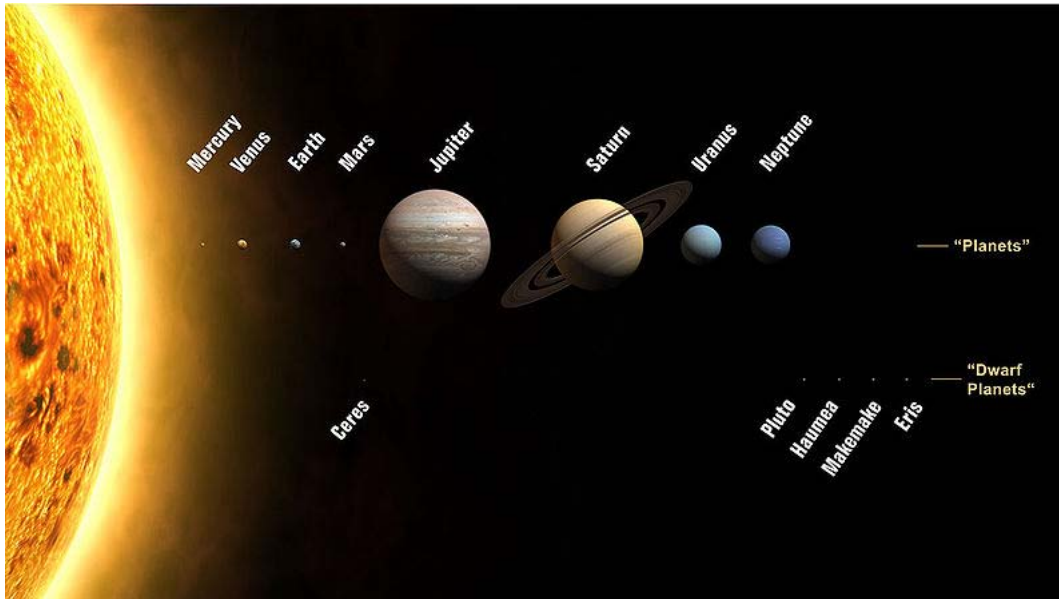


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Application: Space Exploration

- Venus lander has to withstand surface temperatures of 460 °C



<http://en.wikipedia.org/>

Answer to the Call for a Medium-size mission opportunity in ESA's Science Programme for a launch in 2022 (Cosmic Vision 2015-2025)

EUROPEAN VENUS EXPLORER

EVE

An in-situ mission to Venus

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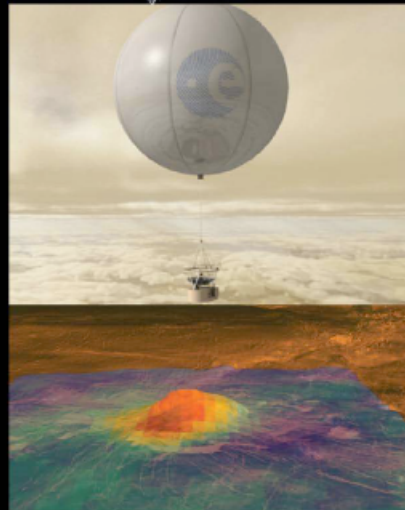
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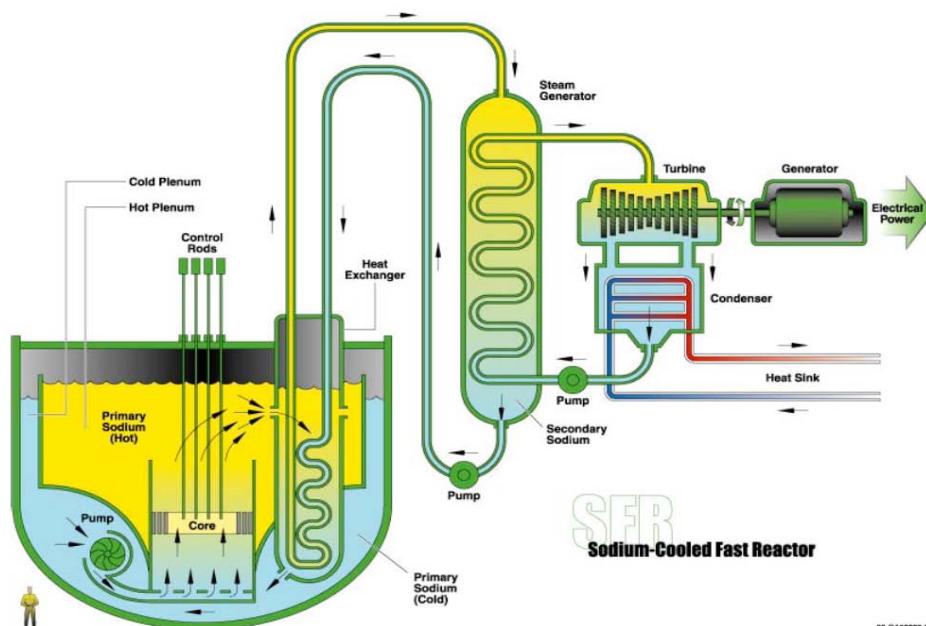
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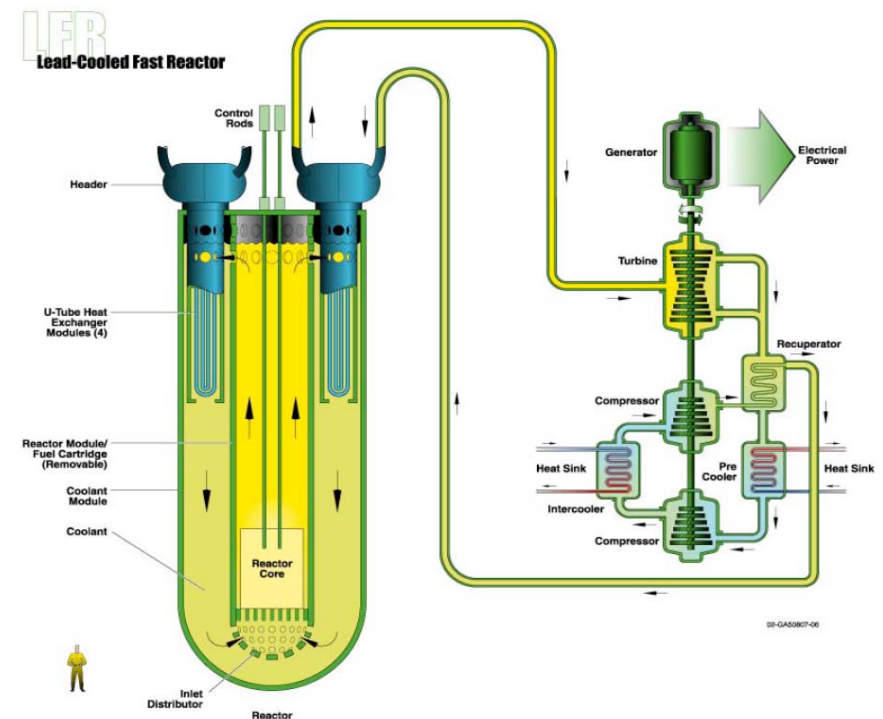
Application:

Nuclear Energy: Generation IV

- Sensor/electronics application in two types of high temperature ($\sim 450^\circ\text{C}$) reactors are being considered:
SFR – Sodium cooled Fast Reactor
LFR – Lead cooled Fast Reactor
- Partner: Prof. Janne Wallenius, KTH Reactor Physics



<http://en.wikipedia.org/>



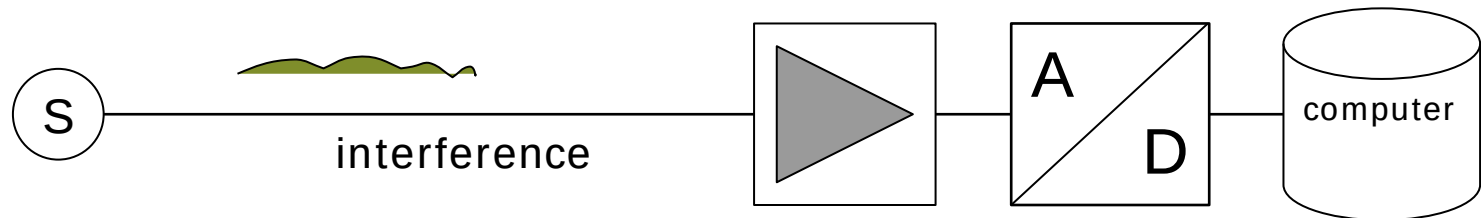
<http://en.wikipedia.org/>

Sensor system: High T IC advantage (and radiation hard)

High T signal interface Low T

SiC:

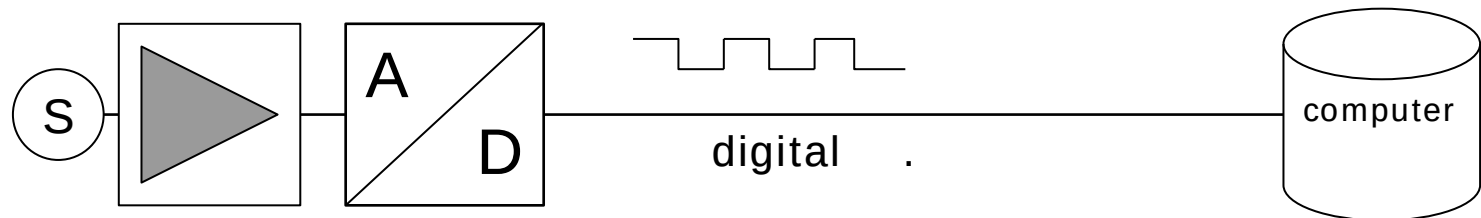
Only sensor



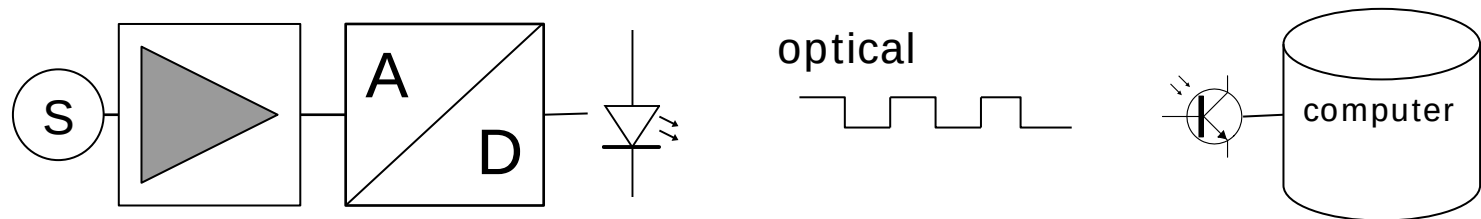
Add amplifier



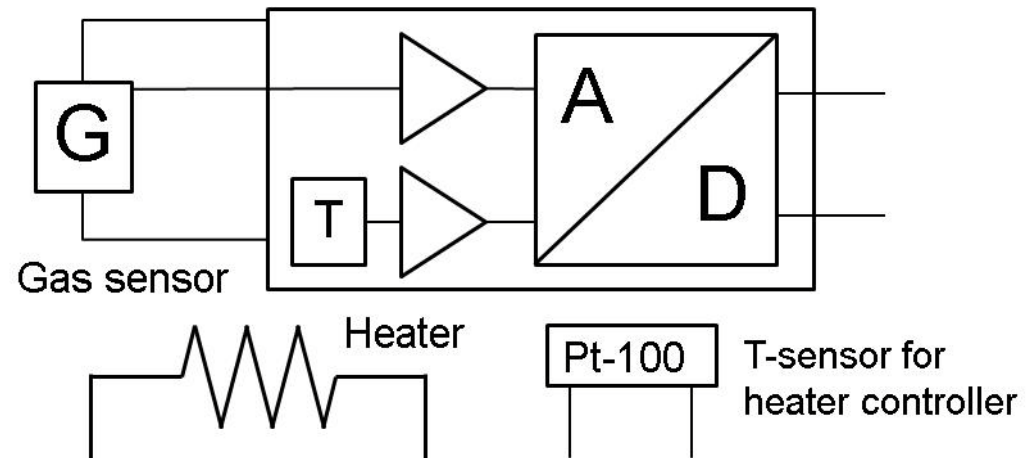
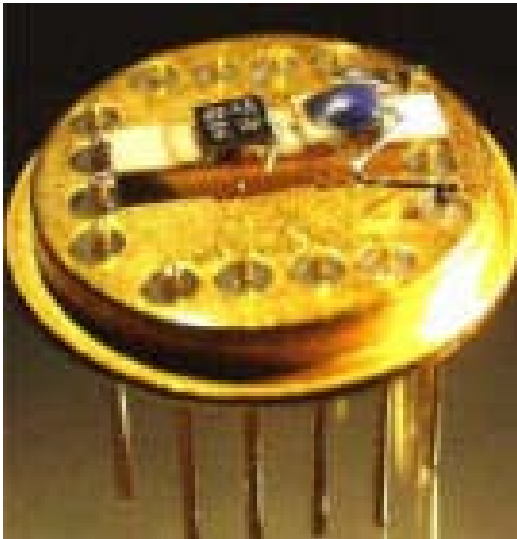
Digital interface



Galvanic isolation



Sensor application demonstrator



A sensor will be integrated in a package with an IC incorporating an amplifier and an ADC (Analog to Digital Converter) for easy interfacing to controllers.

The sensor is a SiC gas sensor with catalytic Pt gate for combustion monitoring .

A confirmed partner for this demonstrator is SenSiC, <http://www.sensic.se>

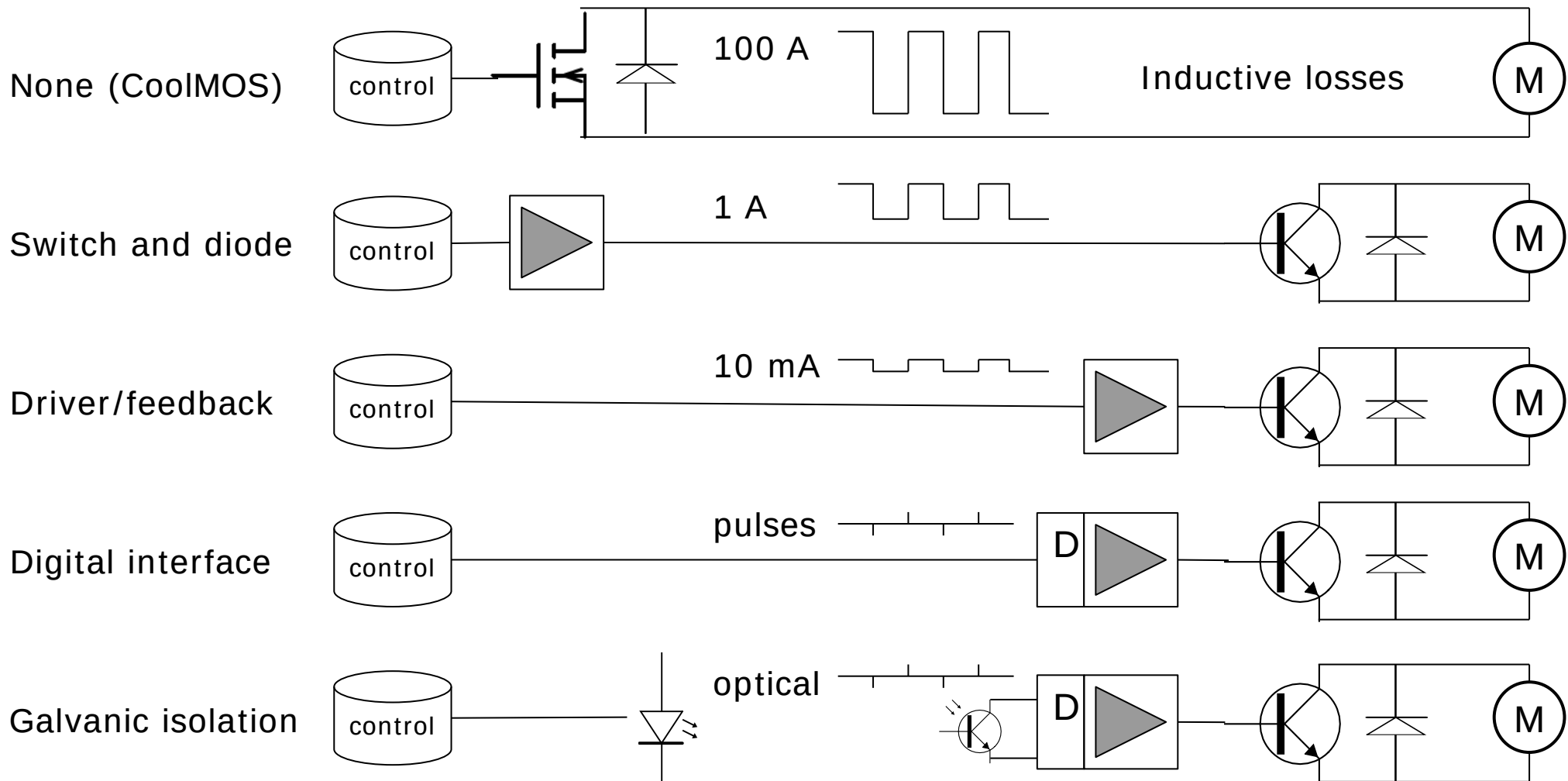
Power system: High T IC advantage

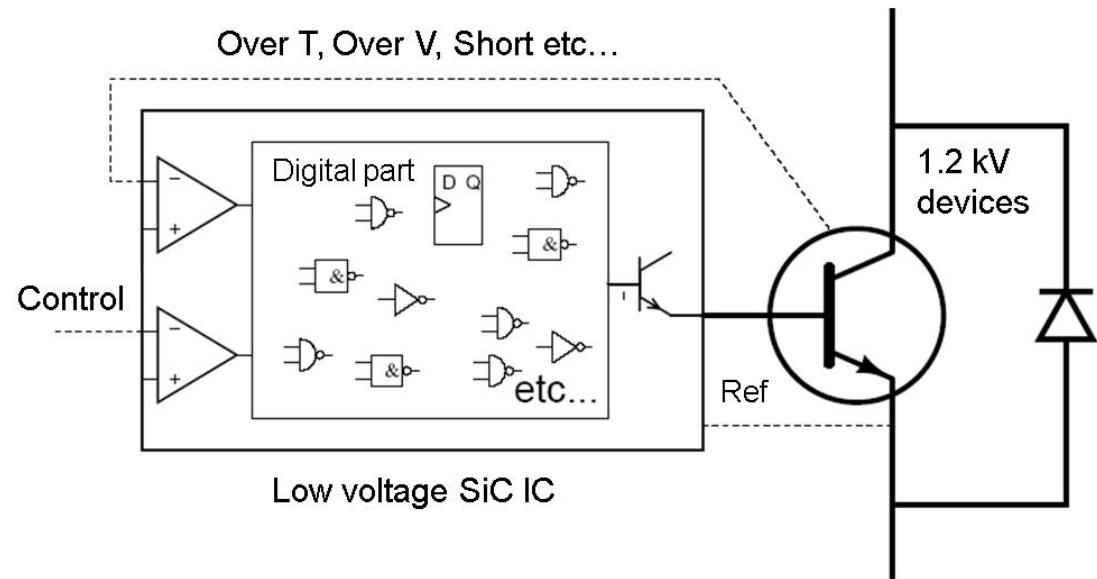
Low T

control interface

High T

SiC:





A confirmed partner for this demonstrator is TranSiC, <http://www.transic.se>

“we chose to do these things
not because they are easy,
but because they are hard”

Interested? Contact
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