

# SMART ICT BY PROMIK

Digital in-circuit/functional testing



# STRUCTURE

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  - Software
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5. Use Cases
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# ProMik SMART ICT

Changes in complexity and structure of modern application require innovative adaptation

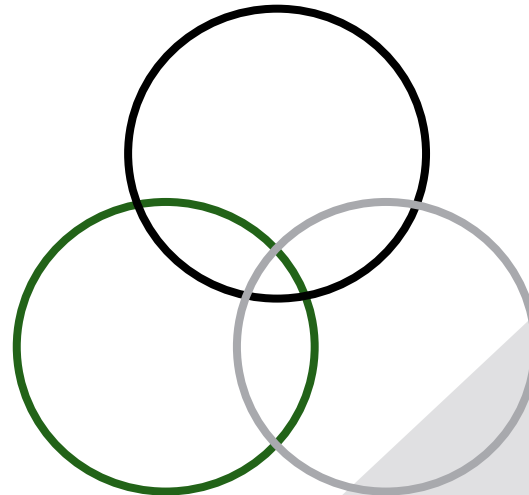
## Reliable supply chain

- No need for tests of component correctness  
→ Higher quality standards of incoming components
- Soldering as well as part detection test via AOI.

## Application trends

Changing requirements/technologies have various effects on the development of applications:

- Smaller PCB size
- Decreasing number of test points
- Changing process compatibility  
e.g. limited X-Ray tests



## Cost and time pressure

Global competition and decreasing prices lead to the need to reduce costs:

- Parallel tests help to reduce cycle times and increase productivity
- Improve test coverage



# SMART ICT

## Conventional Production Concept

Conventional production sequence:

- ICT, Flashing and FCT as separated process steps
- Unbalanced process steps

Schematic process



# SMART ICT

## Integrating ICT and FCT into the flash process

SMART ICT production sequence:

- Smart ICT increasingly replaces ICT and FCT
- Reduced cycle times due to parallel tests
- Balanced process steps

Schematic process

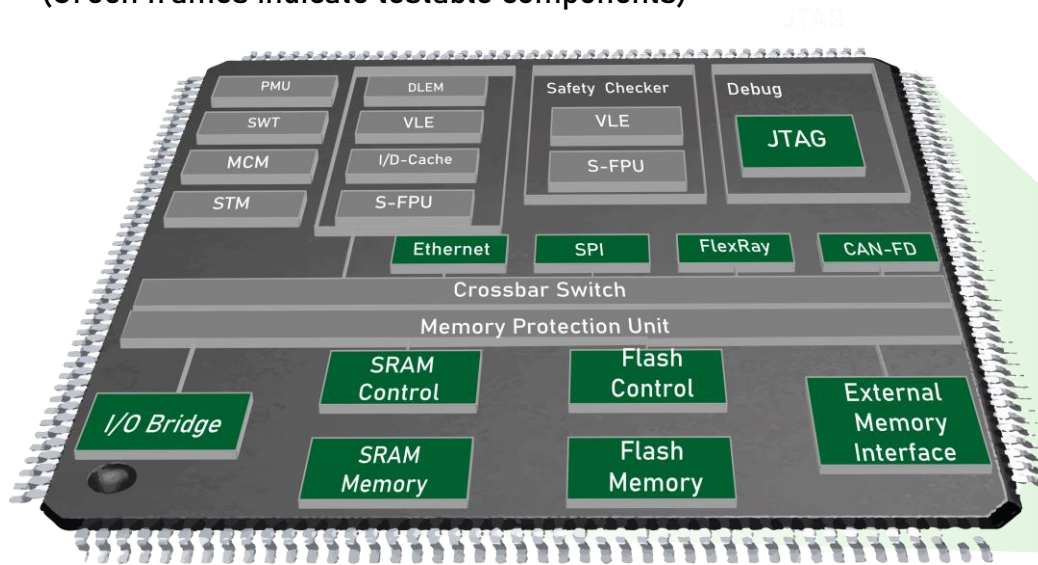




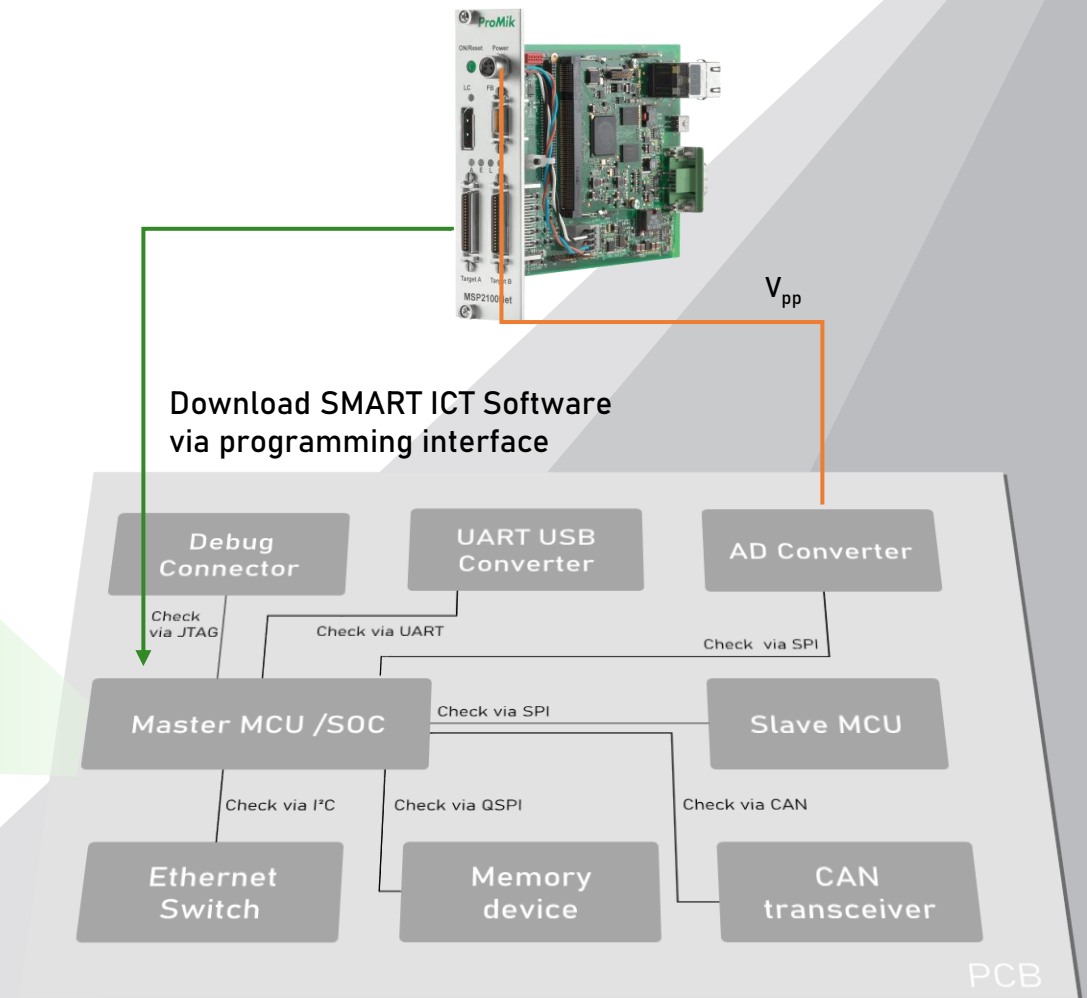
# System Overview

# ProMik SMART ICT System Overview

Exemplary block diagram of NXP Power PC MCU:  
(Green frames indicate testable components)



Internal Device Structure



Full application view



# Toolbox Overview





# ProMik SMART ICT Toolbox Overview

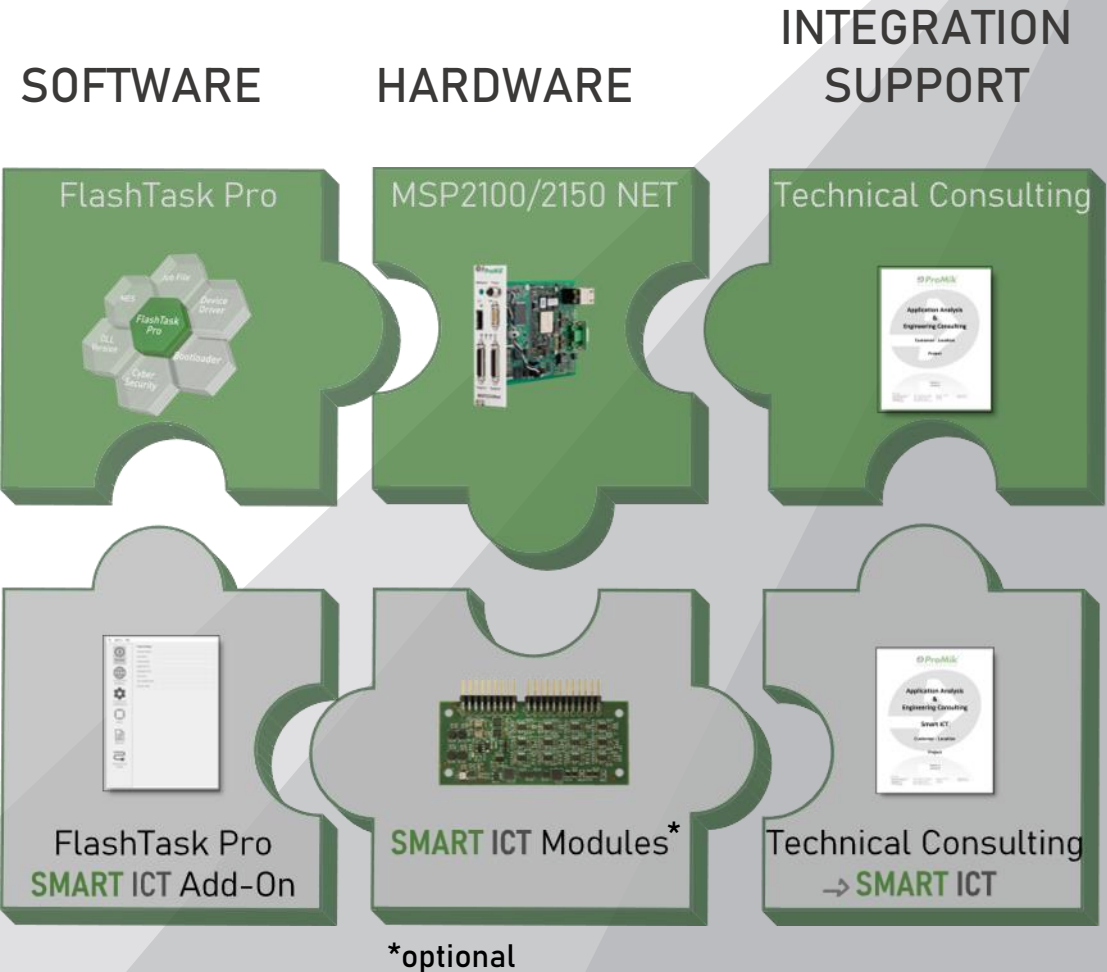
ProMik programming solutions as basis module



SMART ICT software as a Plug&Play upgrade to existing FlashTask software

Flashing Solution

SMART ICT Upgrade



# ProMik SMART ICT

## Software: Scripting Language

Easily manageable  
scripting language

Simple integration

Intuitive parameter definition

Calling predefined  
programming sequence

Flexible SMART ICT function call

Individual SMART ICT sequence

```
1
2 msp = MSP2150net()
3 powerPc = MPC5643L()
4 canIface = CAN()
5
6 msp.log("application power on")
7 msp.power.on()
8 msp.setWatchdog(2000) # 2 kHz watchdog
9
10 canIface.testerpresent( 0x380, # CAN RX ID
11                        0x381) # CAN TX ID
12
13 msp.log("application unlock")
14 if not powerPc.init(15000, # JTAG frequency
15                   4, # cable Compensation
16                   20000) # xtal Clock
17     msp.log("unlock device via CAN")
18     canIface.can_unlock(0x750, # CAN RX ID
19                       0x751) # CAN TX ID
20     powerPc.init(15000, # JTAG frequency
21               4, # cable Compensation
22               20000) # xtal Clock
23
24 msp.log("application program")
25 powerPc.erase()
26 powerPc.data.addfile("data.bin", # Data file
27                    0x80000) # Offset
28 powerPc.program()
29
30 while powerPc.busy(): # Busy wait for programming to finish
31     # Perform other tasks...
32
33 msp.power_cycle()
34
35 msp.log("application perform current measurement")
36
37 sleepCurrent = msp.measure_sleep_current_ms()
38 msp.log("measured sleep current [ms] " + sleepCurrent)
39
40 canIface.wakeUp()
41 runCurrent = msp.measure_run_current_ms()
42 msp.log("measured run current [ms] " + runCurrent)
43
44 msp.power.off()
45 msp.log("application power off")
46
```





## SMART ICT Functions



# ProMik SMART ICT

## Function Overview



### Generic ProMik SMART ICT libraries

- Contain device specific modules
- Intuitive function selection allows project specific SMART ICT sequence configuration

### Examples of ProMik SMART ICT functions

- Application power-up sequence
- Voltage level measurement and current (Run, sleep) consumption monitoring
- Low current measurement (Project specific ProMik hardware necessary)
- Peripheral device and component tests
- Peripheral tests (I/O, AD, PWM ...)
- Direct and indirect tests of glue logic elements
- Fieldbus communication and interface tests
- Direct and indirect functional tests
- Test of actuators (Project specific ProMik hardware necessary)
- Supporting high speed Boundary Scan



# ProMik SMART ICT

## Toolbox: Example Hardware Modules

SMART ICT Module	Description
Power Control Current Sensor (PCCS)	To measure current consumption in $\mu\text{A}$ / $\text{mA}$ ranges (perfectly suited for run-/sleep current measurement)
Galvanic Isolation Module	Separates electric circuits physically in order to avoid influences on flash signals
Power Sequencer Box	Powers up the application in a certain sequence
Frequency Measurement Module	Measures signal frequency
Level Shifter	Adjusts voltages accordingly
LIN Multiplexer	Multiplies LIN signals
Watchdog Trigger	Triggers watchdog to avoid the device to shut down
PSU2048	4 independent output channels 4-50V / 4A / 50 Watts per output
Fuse Charge Pump	Sets fuses of Programmable Devices





## Use Cases



# ProMik SMART ICT

## Use Case: PCCS Module + LIN Multiplexer

### MCU Access

- Download ProMik SMART ICT Software via flash test pads.

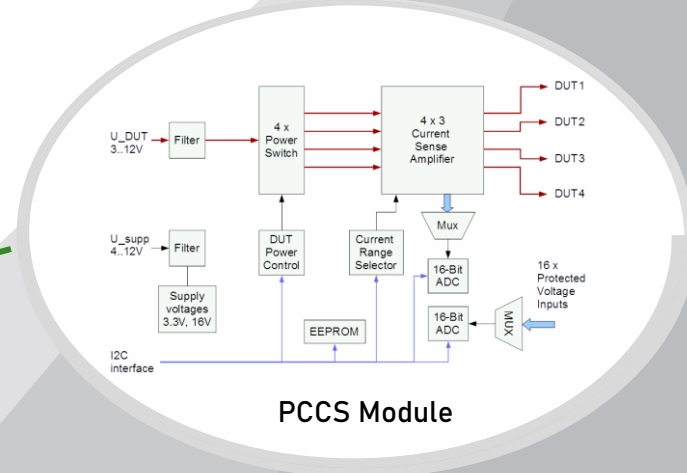
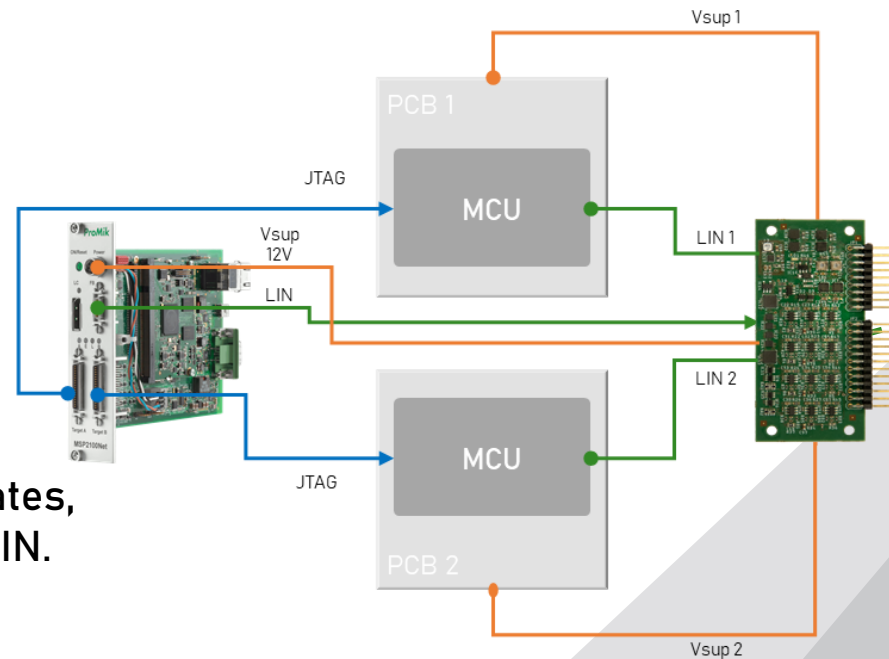
### Communication

- Activate specific application states, like Run- and Sleep mode via LIN.

### Measure Current Limits

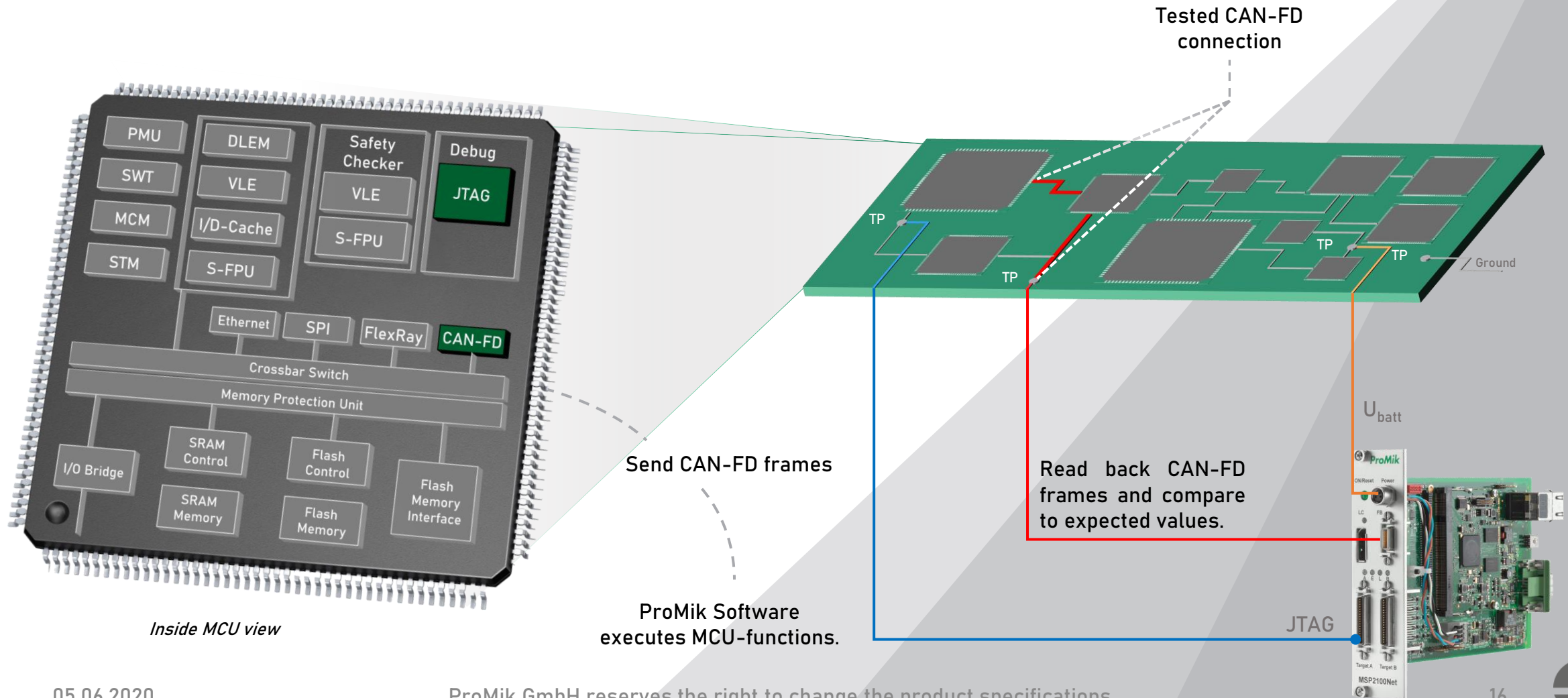
- “State 1” measurement (800  $\mu$ A)
- “State 2” measurement (< 10  $\mu$ A)
- “State 3” measurement (< 100mA)

Traceability through  
MES connection



# ProMik SMART ICT

## Use Case: Test of CAN-FD Communication Interface







## Benefits



# ProMik SMART ICT

## Benefits

Ideally suited for small applications with less or without test pads

- Using target device flash interface
- Parallel access on panel level
- e.g. camera applications, key applications, sensors

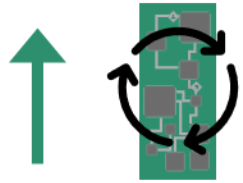
Dynamic control of generic library

- Test engineer has full control over test routines, allowing dynamic test coverage
- Flexible use for various applications
- Configurable I/O lines, interface channels & routines, analogue functions, etc.



# ProMik SMART ICT Benefits

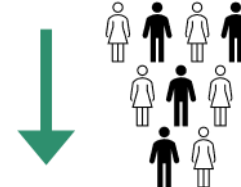
## Costs saving potential



Increased output rate



Hardware cost reduction



Labor cost reduction



Floor space reduction



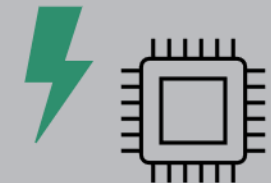
Cost-effective upgrade  
for ProMik FlashTask Pro



Lower process complexity



Reduced und balanced  
cycle times



Early identification of  
defective parts

