

DIGITAL WE DAYS

2024



ROBOTICS DEVELOPMENT PLATFORM.
EXPERIMENT, INNOVATE, ACCELERATE.

Ronald Stärz | Infineon

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT



Infineon's Robotic Development Platform IMR

Experiment, innovate, accelerate

Ronald Stärz
Infineon Technologies Austria



Agenda

1 Ideation

2 System overview

3 Functional blocks

Main Control

Motor Control

Battery Management System

Power Distribution

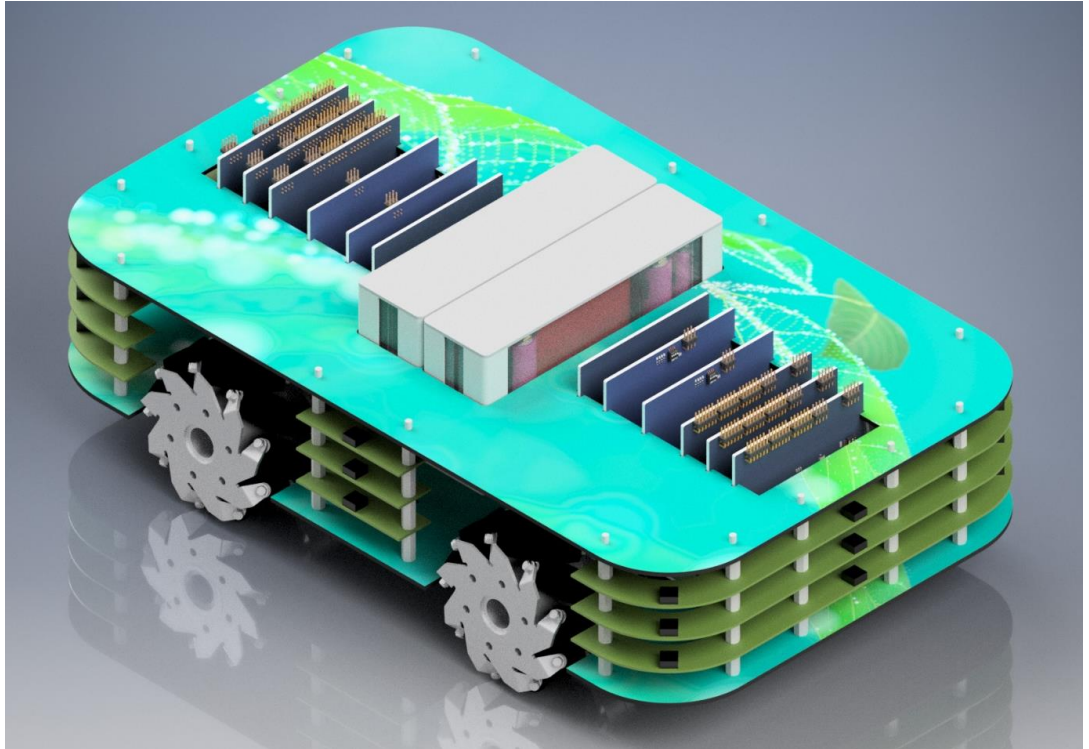
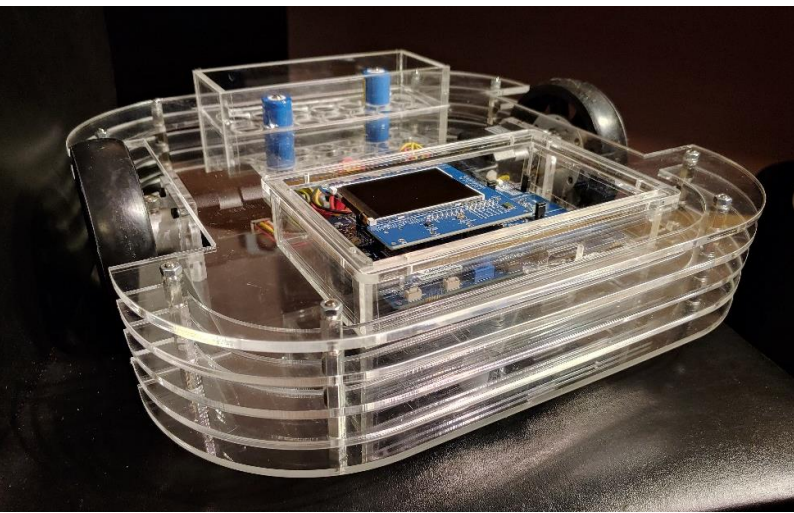
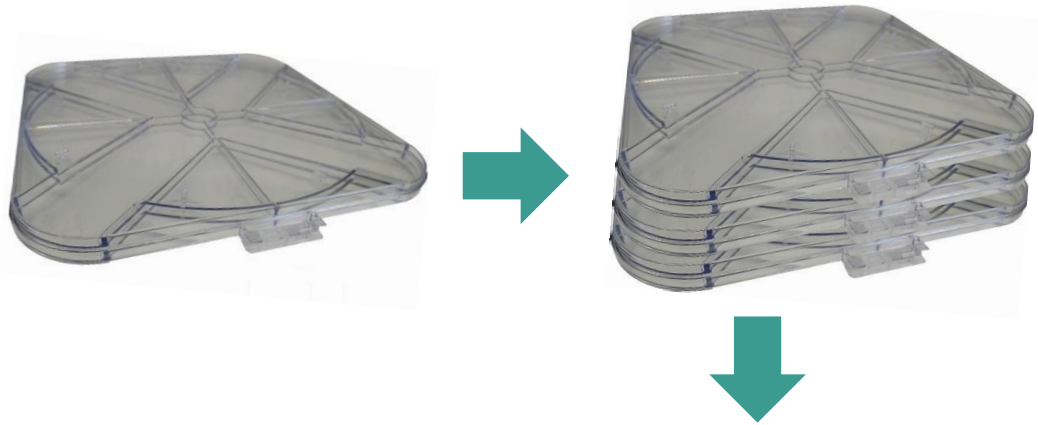
Time of Flight Navigation

4 Ecosystem

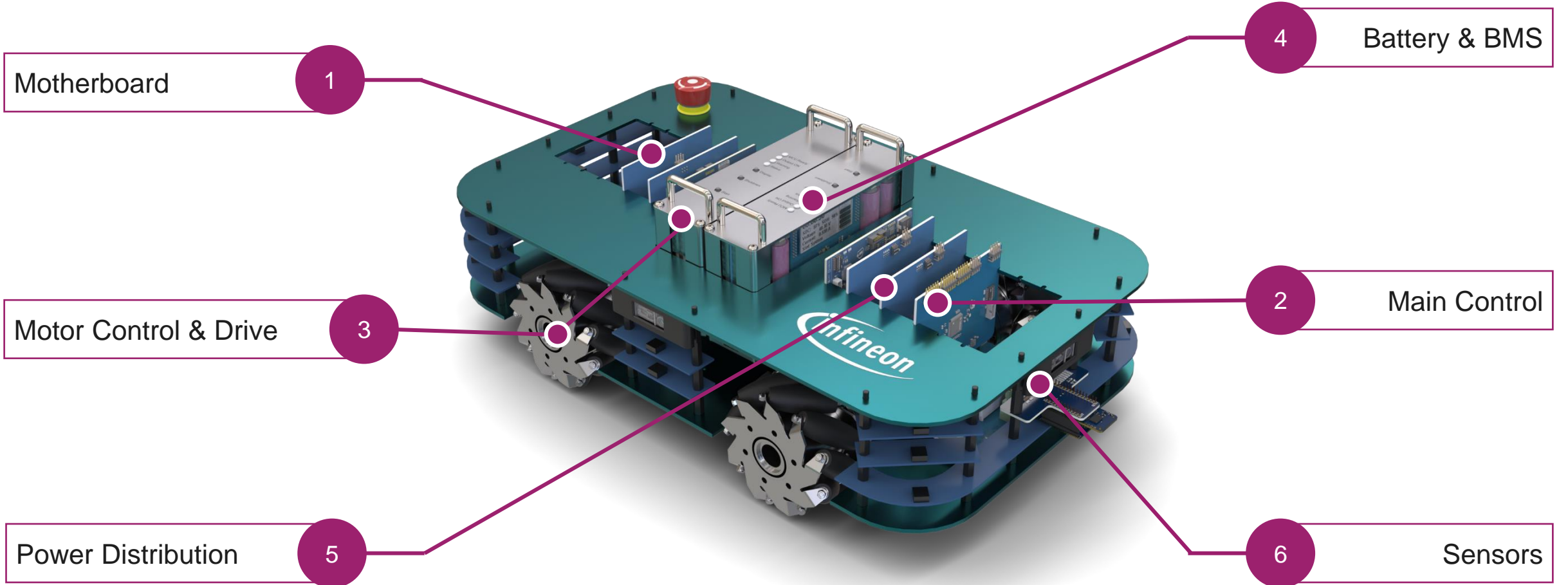
Motivation & Idea behind IMR


- IFX product portfolio
- System solutions
- Partner with universities to familiarize students & talents with Infineon products & solutions
- One stop shop for developments
- Software ecosystem

IMR basic design concept

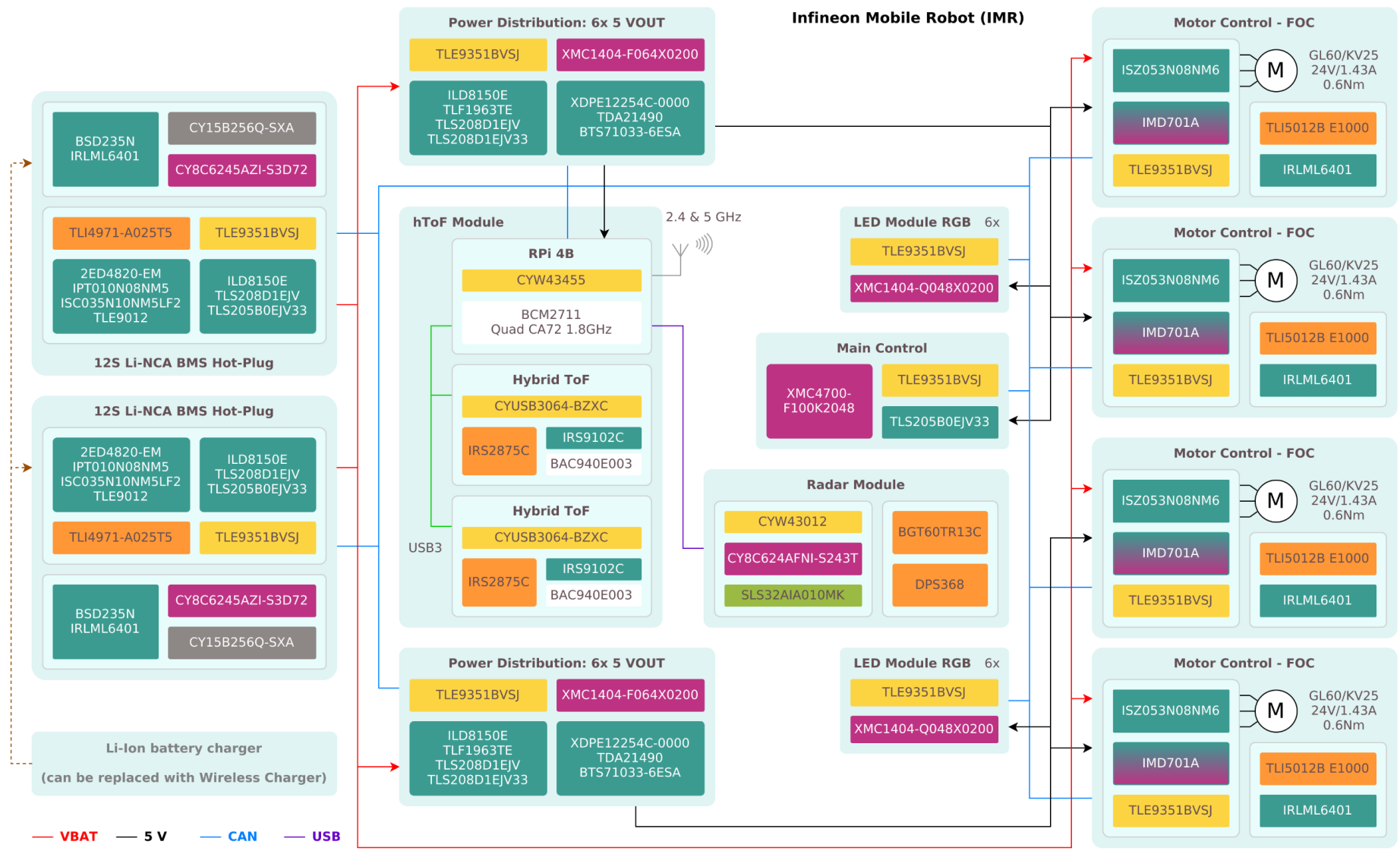


Fast and efficient robot designs with leading technologies and a broad product portfolio to choose from



 [Click here for more Infineon.com/IMR](https://www.infineon.com/IMR)

IMR platform solution



Motherboard

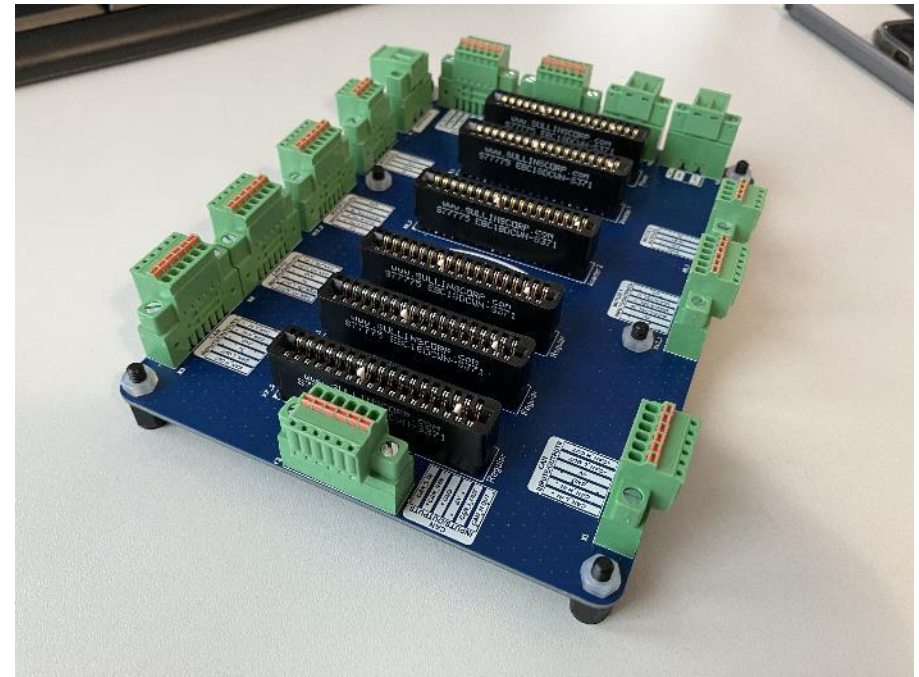
Description

- › 2x Motherboard per IMR
- › Slot with different spacing and keying
- › Enables plug-and-play connections of boards to control:
 - Sensors
 - Motors
 - BMS
 - LEDs

Benefits

- › One slotting system for all sub systems & functional blocks
- › Allowing flexible plug & play operation

Information



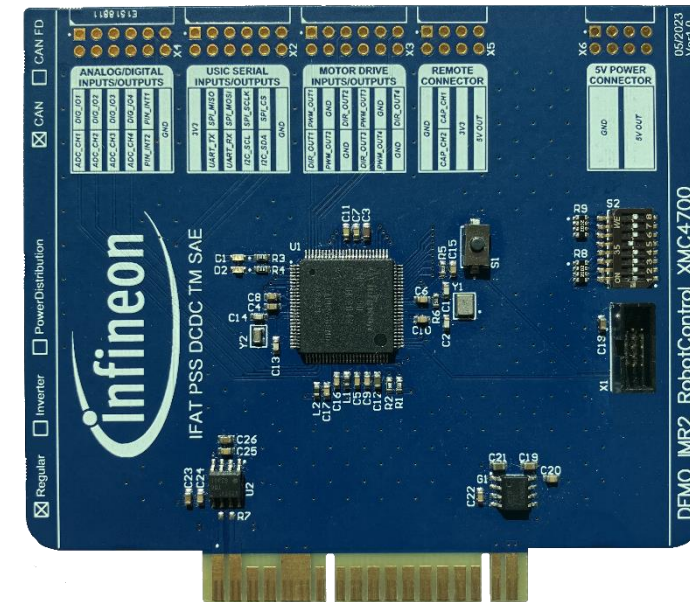
Description

- › Main control enabled by Cortex-M4 MCU
 - XMC4700 Cortex-M4 144 MHz up to 2 MB Flash
- › CAN communication
- › Input Voltage: 5 V

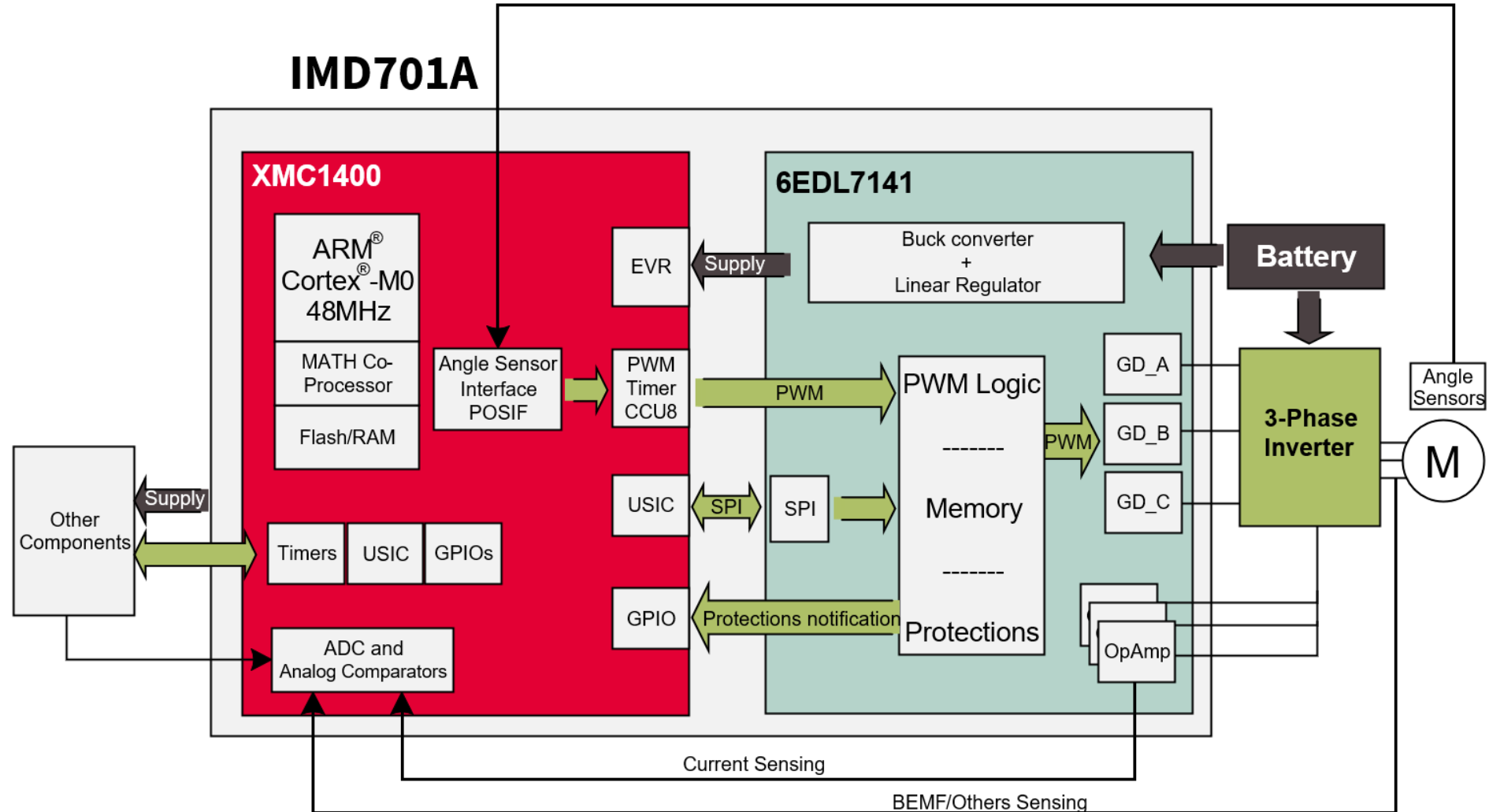
Benefits

- › Central control unit featuring all necessary CAN communication
 - Motor speed to Inverters
 - Lighting effects to Sensor LED boards
- › Implemented SBUS interface for usage with FrSky remote controls

Information



Description	Part Number
Microcontroller ARM Cortex-M4	XMC4700-F100K2048
LDO output 3.3V 0.5A	TLS205B0EJV33
CAN transceiver	TLE9351BVSJ



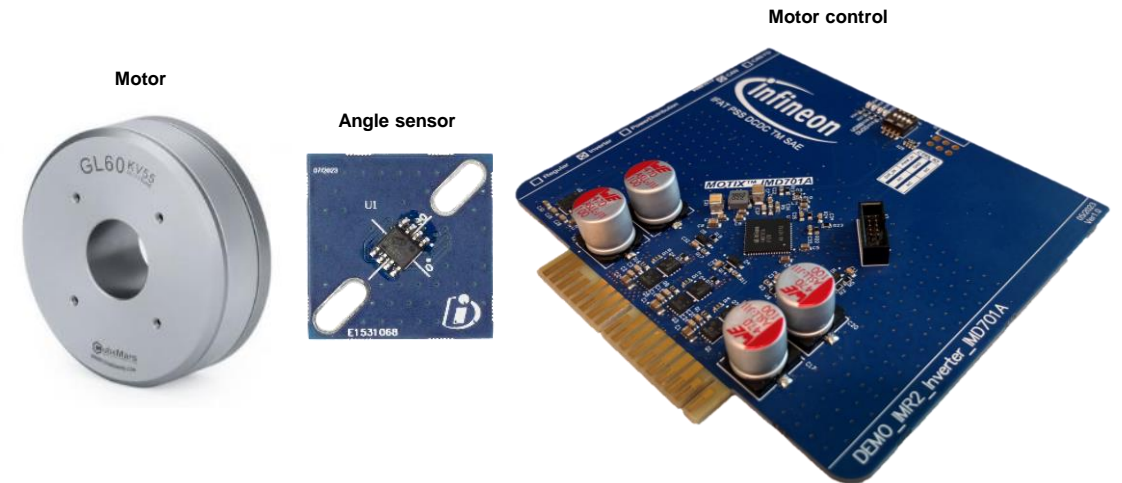
Description

- › Operating voltage: 18 V - 60 V
- › Continues & max. current: 5 A & 7 A
- › Motor control:
 - SVPWM FOC algorithm
 - 20 kHz control frequency
 - Three-phase low side current measurement
 - Sensored implementation using POSIF
- › Motor: T-Motor GL60
 - 24N28P configuration, Kv 25, Kt 0.4 Nm/A
 - 69 mm diameter * 22.3 mm thickness
 - Rated 350 rpm → allows usage without gear
 - Rated voltage, current, and torque: 24 V, 1.43 A, 0.6 Nm

Benefits

- › High efficiency & small form factor
- › Compact design with integrated controller CM0 48 MHz and 3-phase gate driver: IMD701A
- › Latest OptiMOS™ 6 MOSFET technology

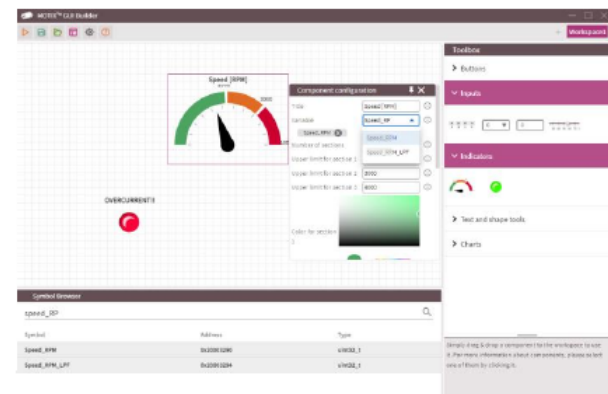
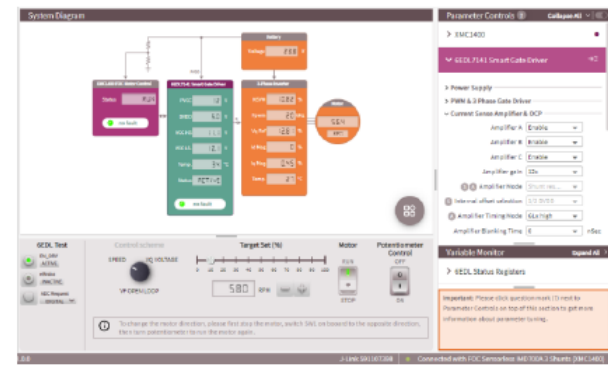
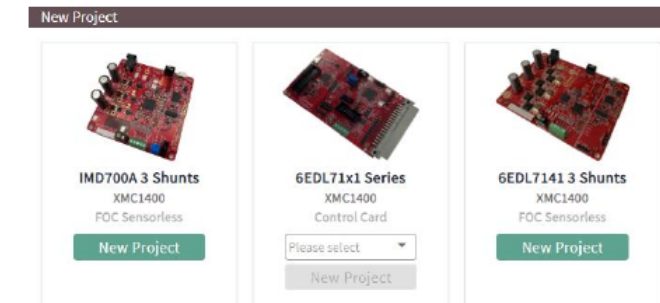
Design information



Description	Part Number
Integrated MCU & Gate Driver: Microcontroller XMC1404 + 3-phase gate driver 6EDL7141	IMD701A
OptiMOS 6™ 80V 5.3mOhm	ISZ053N08NM6
CAN transceiver	TLE9351VBSJ
Angle sensor	TLI5012B E1000
P-CH MOSFET small power	IRLML6401

One Graphical Interface to operate **multiple** evaluation boards and control schemes

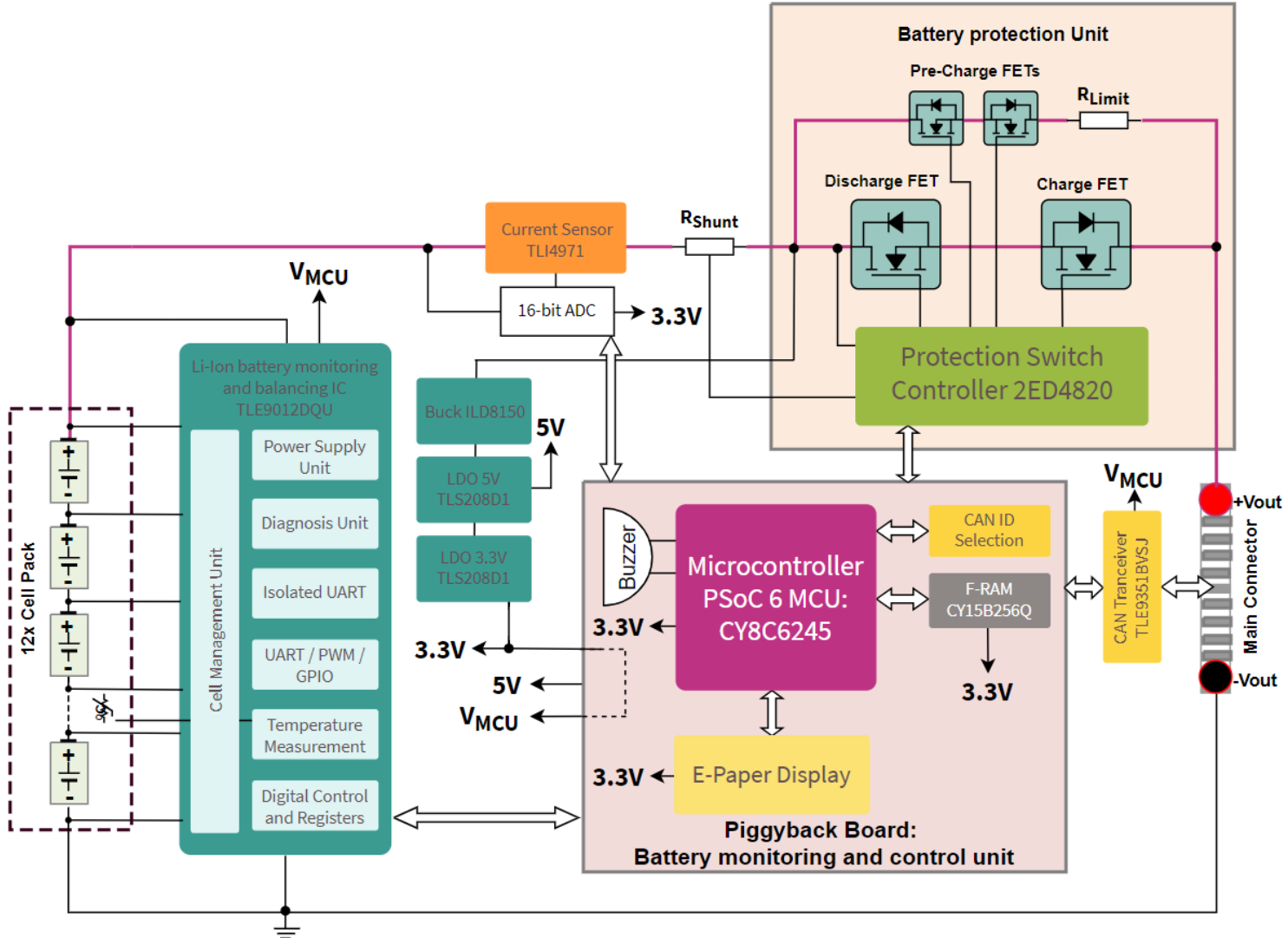
Clear motor control parameters explanation with **user friendly** testbench updated **LIVE**



Easy visual evaluation with embedded Oscilloscope

Build your own GUI Layout for quick and easy debugging / troubleshooting

12S Battery Management System (BMS)



12S Battery Management System (BMS)

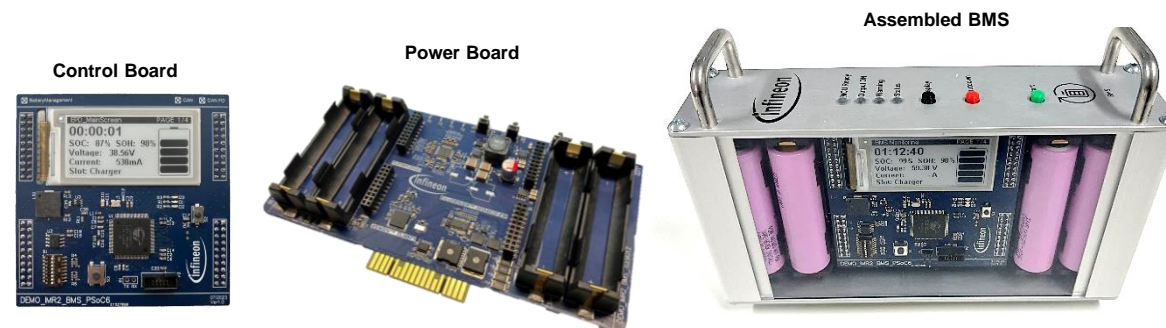
Description

- › 2 x BMS board per IMR
- › 12S Battery Cells
- › Nom. Voltage: 44.4V
- › Voltage range: 30 – 50.4V
- › Charging & discharging rate: 1C & 5C

Benefits

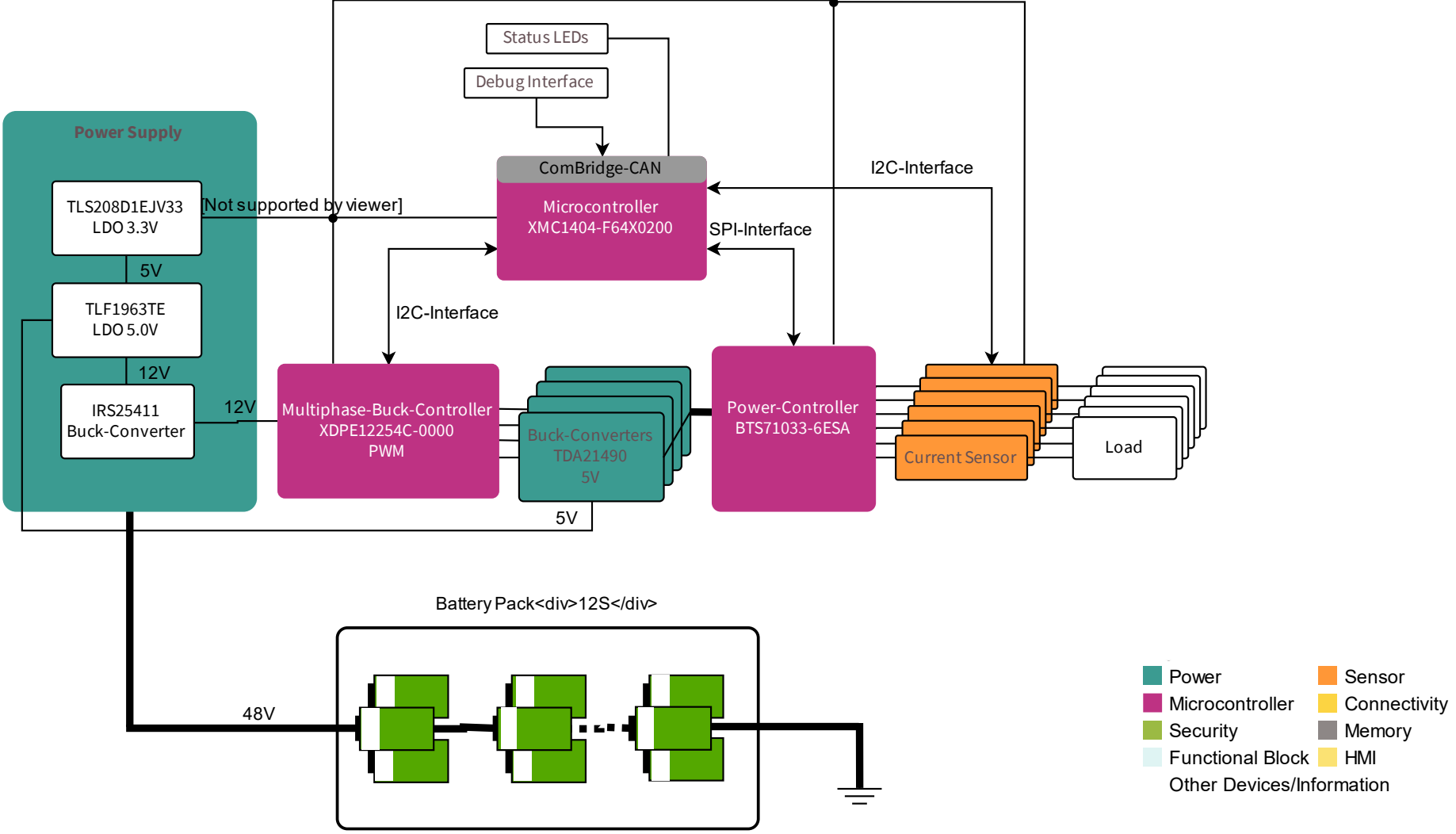
- › Advanced cell monitoring and balancing
- › Temperature management
- › Safety functions, SoC and SoH
- › Extensible, non-blocking software layout
- › Data communication via CAN
- › Modular design featuring two separate boards
 - Power board incl. TLE9012DQU
 - Controller board incl. CY8C6245AZI PSoC6

Design information



Description	Part Number
Gate driver / Charge pump / 48V battery switch	2ED4820-EM
Protection FET	IPT010N08NM5
Pre-charge FET	ISC035N10NM5LF2
BMS IC	TLE9012DQU
Current sensor	TLI4971-A025T5-E0001
CAN transceiver	TLE9351BVSJ
80VIN buck converter (LED driver IC)	ILD 8150
LDO adjustable VOUT 0.8A	TLS208D1EJV
LDO output 3.3V 0.5A	TLS205B0EJV33
MCU PSoC ARM Cortex-M4 & M0+	CY8C6245AZI-S3D72
SPI F-RAM 256kb	CY15B256Q-SXA
Dual-N MOSFET small signal	BSD235N
P-CH MOSFET small power	IRLML6401

Power Distribution



Power Distribution

Description

- › Up to 80 V input voltage
- › 6 x output channels 5 V
 - 3x with up to 3 A output current
 - 3x with up to 1.5 A output current
- › Interleaved buck converter with 4 phases
- › Power controller for individual sleep modes
- › High side switches with diagnosis and protection functions
- › High speed CAN transceiver

Benefits

- › Low power losses
- › Current measurement for all six channels on the output side

Information



Description	Part Number
80VIN buck converter (LED driver IC)	ILD 8150
Multiphase buck controller	XDPE12254C-0000
Buck converter integrated power stage	TDA21490
SPI power controller 6 outputs	BTS71033-6ESA
LDO adjustable VOUT 1.5A	TLF1963TE
LDO adjustable VOUT 0.8A	TLS208D1EJV
LDO output 3.3V 0.8A	TLS208D1EJV33
Microcontroller ARM Cortex-M0	XMC1404-F064X0200
CAN transceiver	TLE9351BVSJ

Hybrid Time of Flight (hToF) Navigation Sensor

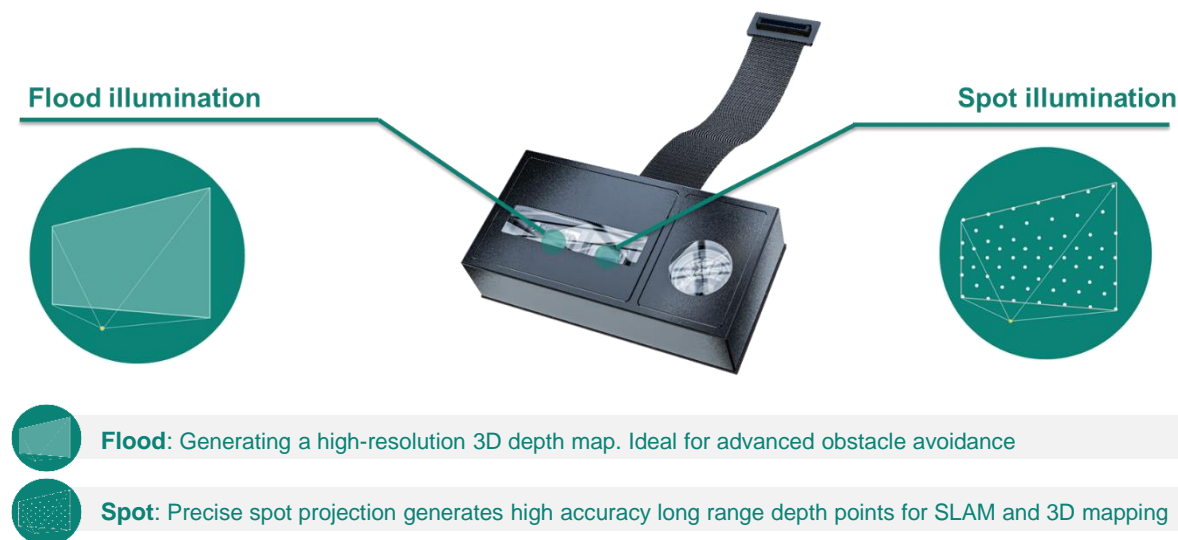
Description

- › IR wavelength: 940 nm
- › Frame rate: 21 FPS
- › Dimensions: 31 x 16 x 8 mm
- › Interface: MIPI (MIPI-USB3 bridge available separately)
- › Combines Flood and Spot Illumination with < 1% depth accuracy for both illuminations
 - Flood Illumination for obstacle avoidance
 - Range 0.05 – 2 m, 20 000 depth points, FoV 100° x 45°
 - Spot Illumination for mapping
 - Range 0.1 – 8 m, 600 spot depth points, FoV 100° x 21°
- › Depth processing available in PMD Royale SDK

Benefits

- › One camera for two applications (SLAM + Obstacle avoidance)
- › Smaller form factor, e.g. 30% thinner robot vacuum cleaner
- › High-definition Advanced Obstacle Avoidance
- › High accuracy and low compute SLAM

Design information



Description	Part Number
Hybrid ToF image sensor	IRS2875C
Hybrid ToF VCSEL driver	IRS9102C
Hybrid ToF MIPI CSI-2 to USB3 bridge	CYUSB3064-BZXC

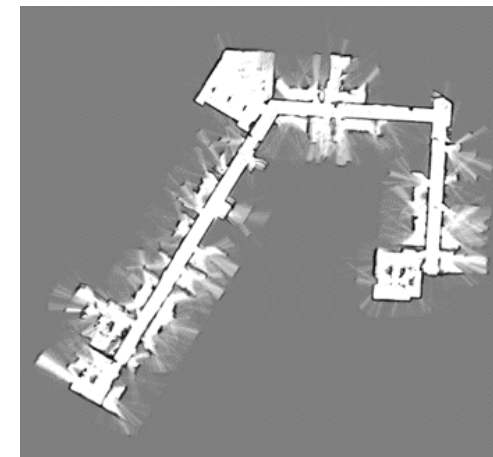
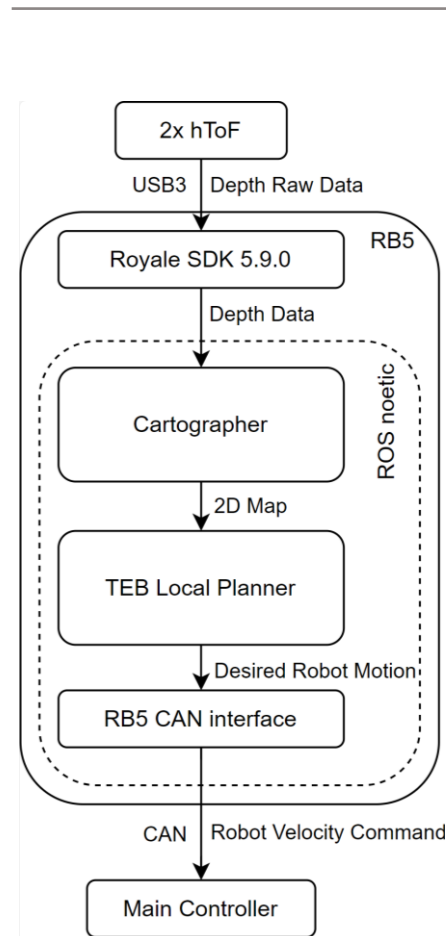
Software: hybrid ToF processing

Description

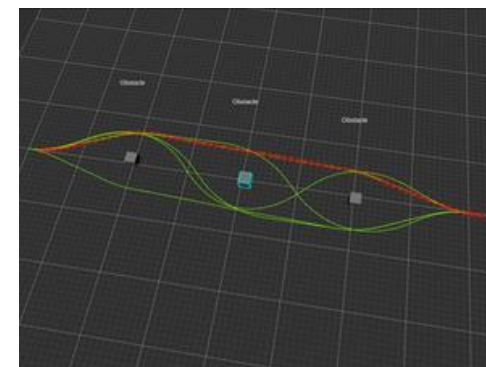
- › Data from two hToF cameras is transferred to and processed on a [Qualcom RB5](#) (on-board) via USB3
- › From the depth information, a 2D map is generated (SLAM), with [Cartographer](#) Algorithm
- › A path between two interactively set points is found by [TEB Local Planner](#) (Trajectory Generator) and followed by the robot.
- › OS: Ubuntu 20.04.06 running on Qualcomm RB5
- › Middleware: ROS noetic

Benefits

- › One camera for two applications (SLAM + Obstacle avoidance)
- › Smaller form factor, e.g. 30% less height of vacuum cleaner robot
- › High-definition Advanced Obstacle Avoidance
- › High accuracy and low compute SLAM



Map generated by SLAM



Generated trajectory around obstacles

Interactive web presence



<https://www.infineon.com/cms/en/applications/robotics/development-platform/>

Robotics development platform: Infineon Mobile Robot (IMR)



Overview

Get a head start on the development of your robot with Infineon's robotics development platform, powered by our state of the art hardware and software

Products

The Infineon Mobile Robot, or IMR for short, is a robotics development platform that demonstrates the latest that Infineon offers for the robotics application. Whether you are shopping for one specific sub-system/functional block, or looking to build an entire system with Infineon, we have you covered with our powerful, convenient, and efficient hardware and software solutions. The below windows will help to guide you to the information most helpful for your expertise level.

Design Support

Documents

Highlights

Videos

Support

Beginner

You are new to robotics but eager to experiment and learn? Explore our **robotics developer community reads** that walk you through each aspect step by step.

Intermediate

You are an experienced designer and want to test out Infineon's solutions for your next robot? Check out the interactive graphic below to explore our demo boards.

Expert

You are a veteran of many robot designs? You know exactly what you need? Skip right to the block diagram to view the individual products used in each IMR demo board.

Interested in seeing Infineon's solutions for robotics in action? Now you can, with our robotics development platform, the Infineon Mobile Robot (IMR) including hardware and software packaged into demo boards, design files, user guides, references, and more to support your designs. Experiment, innovate, and accelerate with IMR from Infineon.

Main control

Motor control and drive

Battery management system (BMS)

Power distribution

Hybrid ToF: object detection and navigation

Radar: surface detection

Interactive Board design example

Overview (nothing clicked)

– Stage 1

Overview (hovered onto graphic)

– Stage 2

Overview (MC clicked - example)

– Stage 3

Interactive web presence



<https://www.infineon.com/cms/en/applications/robotics/development-platform/>



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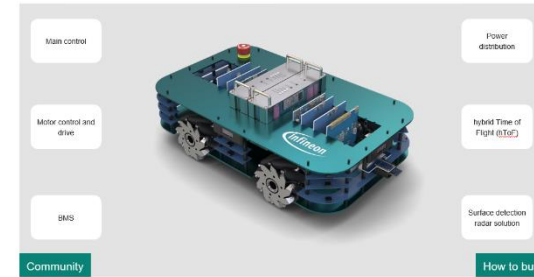
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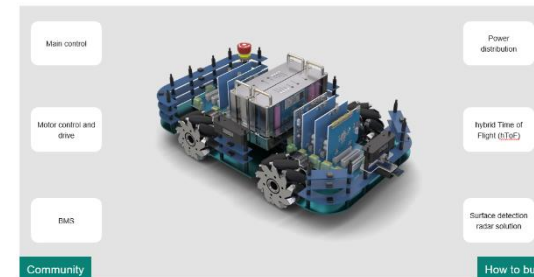
Interactive Board design example

Overview (nothing clicked)



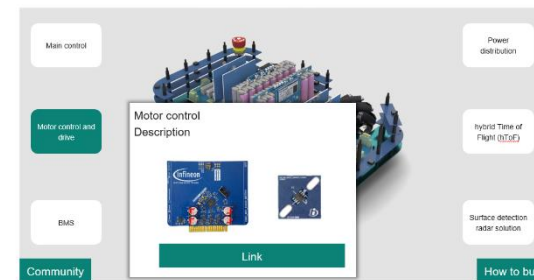
Stage 1

Overview (hovered onto graphic)



Stage 2

Overview (MC clicked - example)



Stage 3



Questions

& Answers



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Ask us directly via our chat or via E-Mail.

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