MEN Mikro Elektronik GmbH
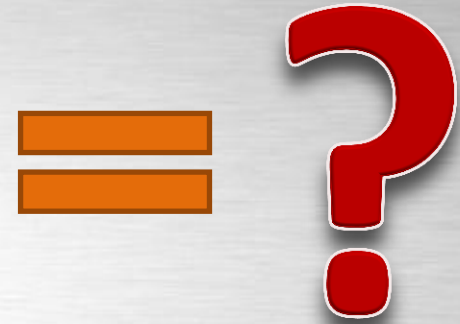
Rugged Computer Boards and Systems for Harsh, Mobile and Mission-Critical Environments.

THE GLOBAL COMPACT
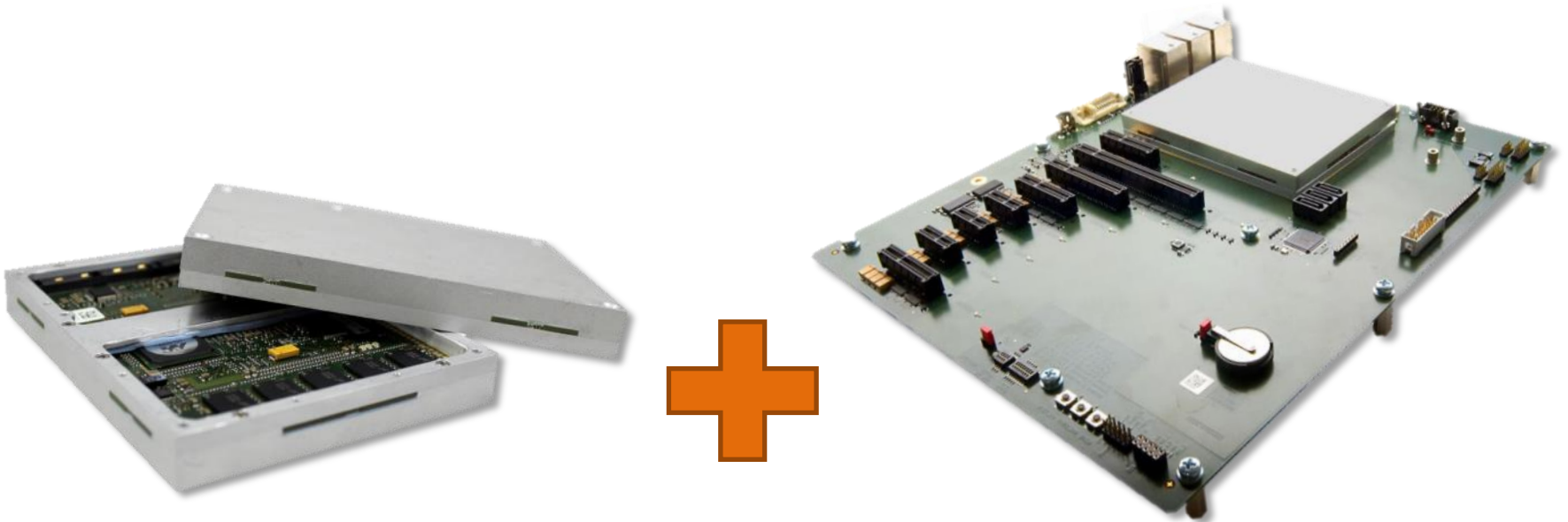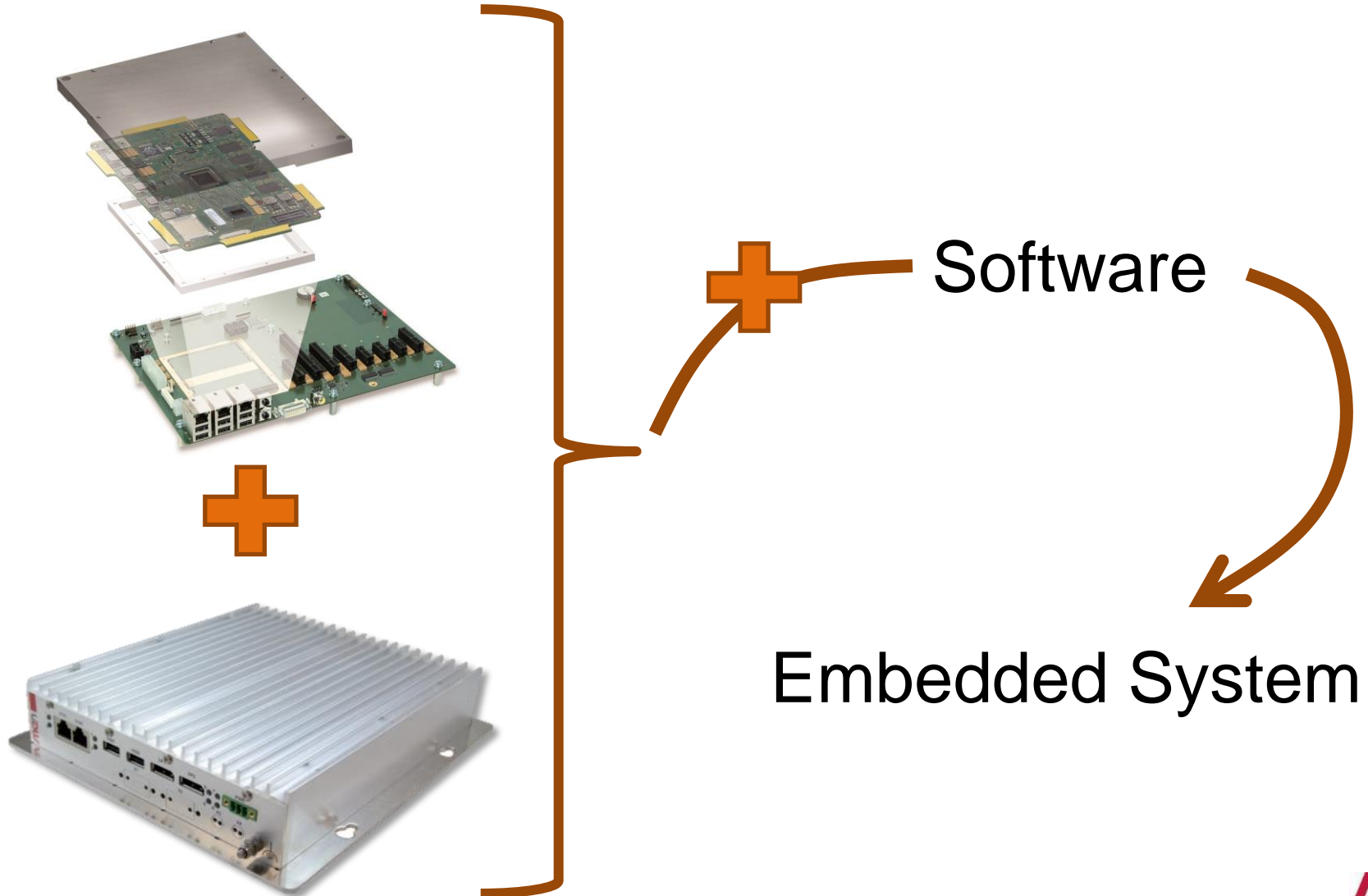HUMAN RIGHTS | LABOUR | ENVIRONMENT | ANTI-CORRUPTION

As a member of the UN Global Compact Initiative, MEN is committed to follow the principles of human rights, labor, environment and anti-corruption as defined by this organization.

Our Challenge for Today

As a member of the UN Global Compact Initiative, MEN is committed to follow the principles of human rights, labor, environment and anti-corruption as defined by this organization.

First Step – Modular CPU-Boards

Second Step – Flexible I/O Configuration

Third Step – The Final System

Software

Embedded System

Popular COM Families

XTX eXpress Technology for ETX

Distribution	★ ★ ★
CPU types	★ ★
Interfaces	★ ★
Connector	★ ★
Form factor	★ ★
Up-to-date	★ ★

Q SEVEN

Distribution	★ ★ ★ ★
CPU types	★ ★
Interfaces	★ ★
Connector	★
Form factor	★
Up-to-date	★ ★ ★ ★

SMARC

Distribution	★ ★
CPU types	★ ★
Interfaces	★ ★
Connector	★
Form factor	★ ★
Up-to-date	★ ★ ★ ★

COM Express®

Distribution	★ ★ ★ ★ ★
CPU types	★ ★ ★ ★ (★)
Interfaces	★ ★ ★ ★ (★)
Connector	★ ★ ★
Form factor	★ ★ ★ ★
Up-to-date	★ ★ ★ ★

COM Express Signal Overview

Pin-Out Type 10

A	B
Gigabit Ethernet	LPC
	SMB
	I²C
SATA	SATA
n/c	n/c
AC97/HD Audio	AC97/HD Audio
USB 1.1./2.0	USB 1.1./2.0
USB 1.1./2.0	USB 1.1./2.0
USB 1.1./2.0	USB 1.1./2.0
USB 1.1./2.0	USB 1.1./2.0
PCI Express	PCI Express
PCI Express	PCI Express
n/c	n/c
GPIO/SDIO	GPIO/SDIO
LVDS A	Digital Display Interface (DDI)
3V for RTC	
SPI	5V Standby
Serial COM	Power
Serial COM	
Power	

Pin-Out Type 6

A	B	C	D
Gigabit Ethernet	LPC	USB 3.0 only	USB 3.0 only
	SMB	USB 3.0 only	USB 3.0 only
	I²C	PCI Express	PCI Express
SATA	SATA	PEG	PEG
SATA	SATA	PEG	PEG
AC97/HD Audio	AC97/HD Audio	PEG	PEG
USB 1.1./2.0	USB 1.1./2.0	PEG	PEG
USB 1.1./2.0	USB 1.1./2.0	PEG	PEG
USB 1.1./2.0	USB 1.1./2.0	PEG	PEG
USB 1.1./2.0	USB 1.1./2.0	PEG	PEG
PCI Express	PCI Express	PEG	PEG
PCI Express	PCI Express	Digital Display Interface (DDI)	Digital Display Interface (DDI)
PCI Express	PCI Express		
GPIO/SDIO	GPIO/SDIO	Digital Display Interface (DDI)	
LVDS A	LVDS B		Power
3V for RTC	VGA	Power	
SPI	5V Standby		
Serial COM	Power		
Serial COM			
Power			

COM Express Form Factors

COM Express® mini — 55 mm × 84 mm

COM Express® compact — 95 mm × 95 mm

COM Express® basic — 95 mm × 125 mm

COM Express® extended — 110 mm × 155 mm
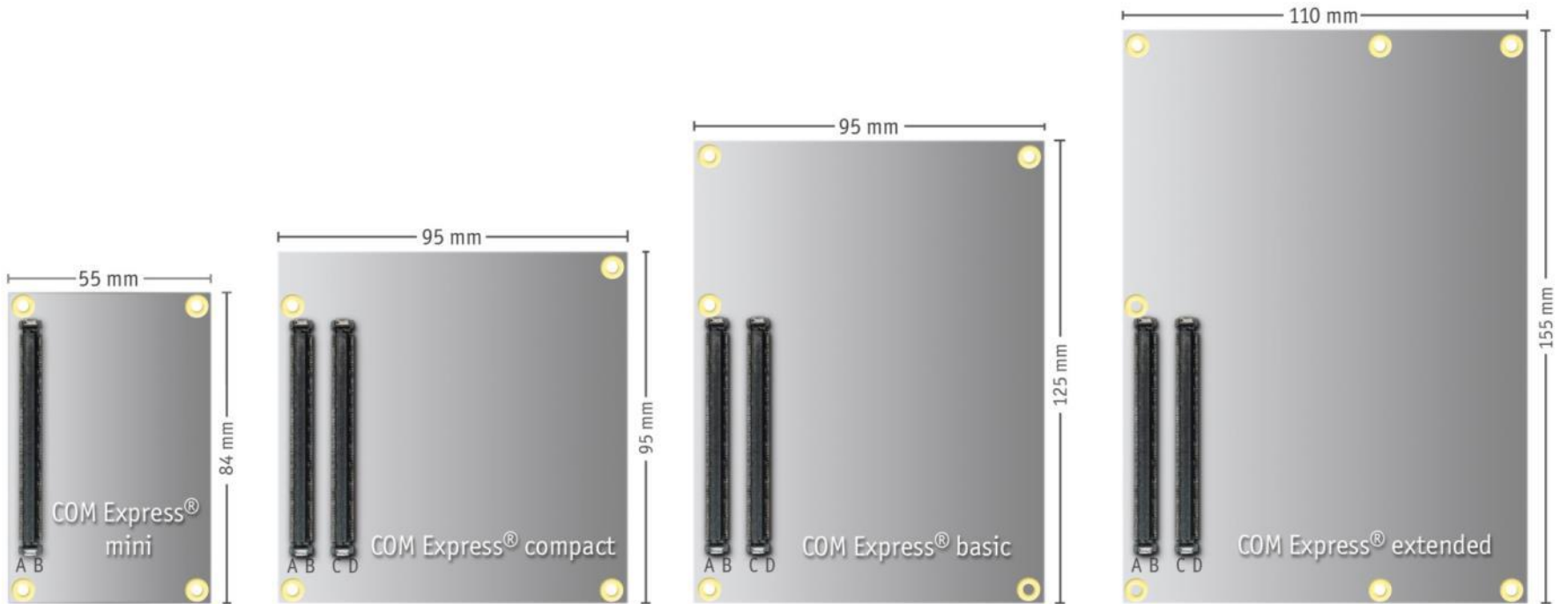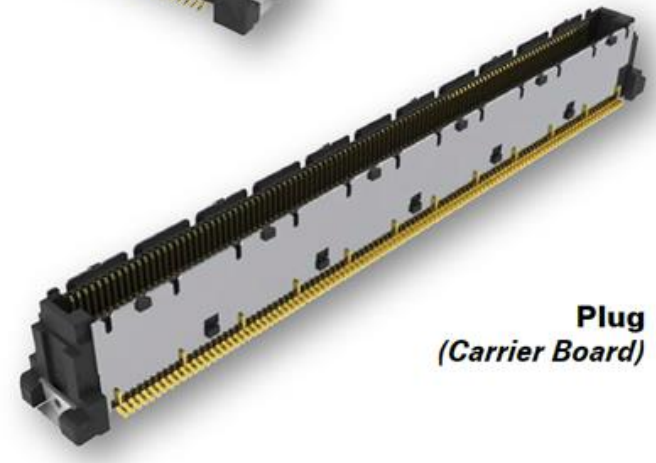
COM Express Connectors

220

440

up to 8 Gbit/s

Receptacle
(COM Module)

Plug
(Carrier Board)

RCE in Mission-Critical Applications

Considerations for System Designs

- Application examples
- Challenges
- Solutions

Rail – Driver Desk HMI for Trains

The application

- Replacement of locomotive cab display
- Rugged display unit under QNX
- IP65 front plate with touch keys

The challenges

- Conformal coating
- Vibration
- Shock proof
- -40 to +85°C (passive cooling)

The solution

- Rugged COM Express
- RCE Compact Module with AMD G-Series

Rail – Locomotive Drive Control

The application

- Central or remote control and diagnosis system for all functions of the freight locomotive

- Complete customized system fully compliant to EN 50155

- Modular DIN-rail units for flexible configuration

The challenges

- Conformal coating

- Vibration

- Shock proof

- -40 to +125°C (passive cooling)

The solution

- Rugged COM Express

- RCE Mini Module with Freescale PowerPC

Mining Machines – Control Platform

The application

- Master controller for the control and automation system
- 2 independent standard COMs to reach SIL2
- VxWorks and Windows XP Embedded
- IP67 compliant housing
- > 10 years availability

The challenges

- Extreme low EMC values inside the housing to show freedom from feedback between both CPUs
- Extremely high vibrations (up to 5G)
- Shock proof (up to 50G)
- -10 to +85°C (passive cooling)

The solution

- Rugged COM Express
- RCE Mini Modules with Intel Atom

Commercial Vehicles – SCADA Box

The application

- **S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition system
- Used for traffic (fleet) management, mobile control and access
- Compact CCA box with wireless (WIFI, UMTS) functions
- Multiple CAN, UART and automotive interfaces inside FPGA
- Linux OS

The challenges

- E-mark and customer norms
- Extreme low EMC values
- High ESD requirements
- Extreme high vibrations (up to 5G)
- Shock proof (up to 25G)
- -40 to +85°C (passive cooling)

The solution

- Rugged COM Express
- RCE Compact Module with Freescale i.MX ARM CPU

Avionics – Display Processor

The application

- Flight-critical avionics display for small to medium commercial aircraft
- Computer-On-Module used in various types of displays up to DAL A
- Sophisticated power control and thermal management
- > 10 years availability

The challenges

- Vibration
- Shock proof (up to 15G)
- -40 to +85°C (passive cooling)

The solution

- Rugged COM Express
- RCE Basic Module with Freescale QorIQ

Medical – Ventilators for Intensive Care

The application

- Control of ventilation (sometimes mobile) devices with patient monitoring
- Application-specific I/O completely in FPGA graphics, binary I/O, pulse width measurement, quadrature decoder and frequency counter
- Specific carrier board developed by customer
- VxWorks OS

The challenges

- Extreme low EMC values
- High ESD requirements
- Vibration (up to 2.5G)
- Shock proof (up to 25G)
- -40 to +70°C (passive cooling)

The solution

- Rugged COM Express
- RCE Compact Module with Freescale i.MX ARM CPU

Rugged COM Express – Motivation and Markets

Rapidly growing market for rugged COMs

- Especially in mobile applications
- Supporting low-power to high-performance computer platforms

Need to meet the requirements of the overall solution

- Respecting the temperature envelope
- Withstanding shock, vibration, humidity and dust
- Adapting to environmental market standards

Clear definition of pin-out and size

- Pin-out and PCB size guaranteed by PICMG COM Express
- Robustness guaranteed by VITA 59 standard
- Supports easy replacement and long-term availability
- Reduces cost and shortens design cycles

VITA 59: Rugged COM Express (RCE)

VITA 59: Rugged COM Express

Why a new COM standard?

- Easy adaption for rugged applications
- Compatibility to COM Express
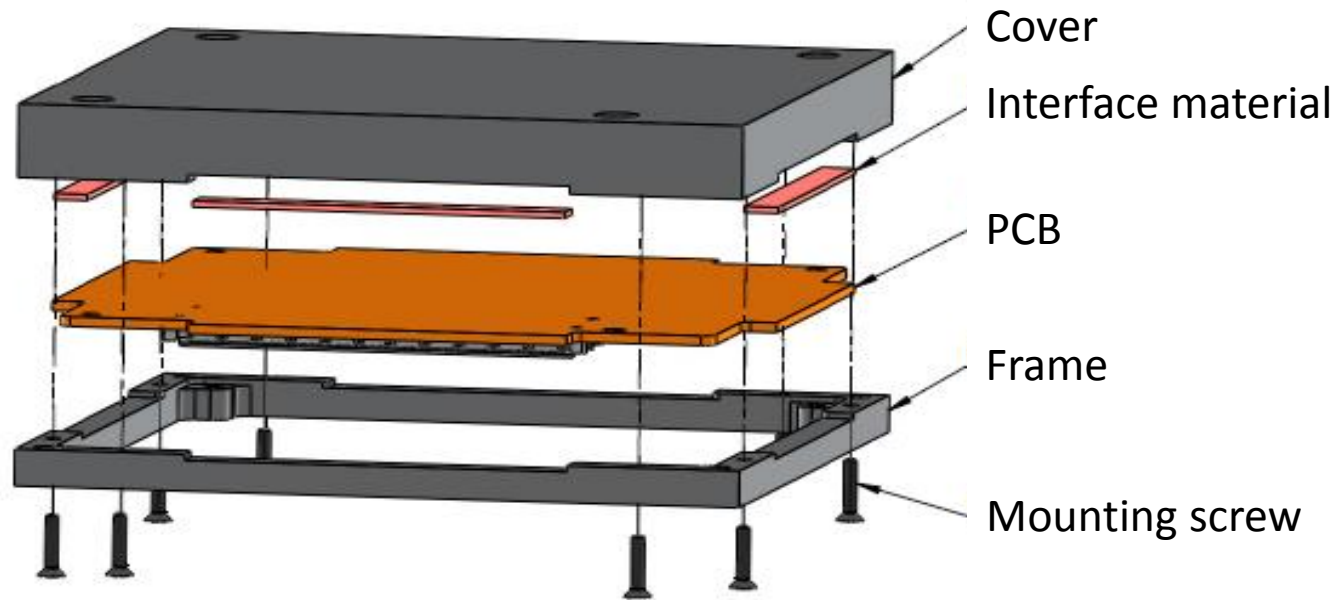- Two solutions with one design
- Fast time-to-market

VITA 59 Form Factors
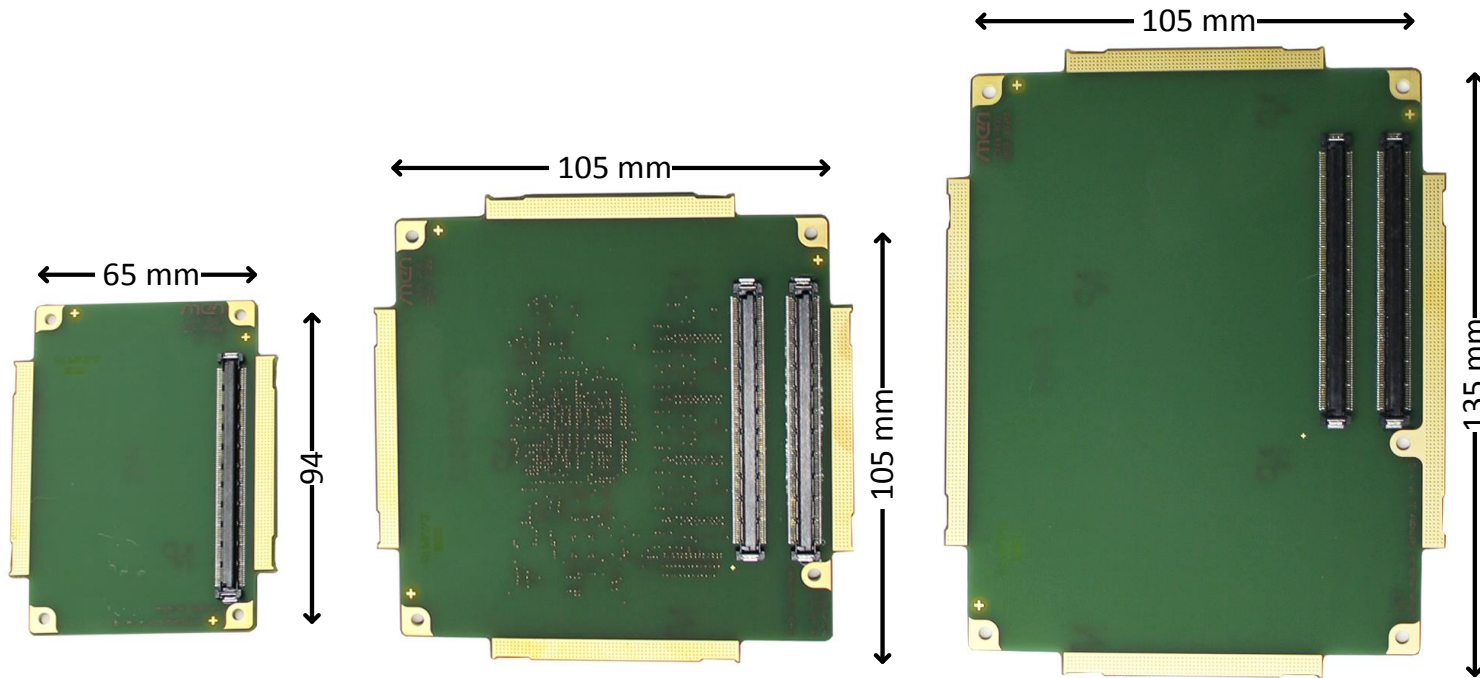
VITA 59 specified rules for RCE modules

- Stacking height 5mm
- Module height 18mm
- Connector position
- Mounting holes for heat sink and module attachment
- Carrier board attachment surface

Rugged COM Express – Possible Mechanics

Cover

Interface material

PCB

Frame

Mounting screw

VITA 59 appendix content

- Surrounded by 5mm "wing extension" for cooling and mounting
- Drawings for cover and frame production
- Guideline for mounting possibilities
- Hints for thermal design

Thermal Concept for Passively Cooled Embedded Systems

- PBC helps to transport the heat to the cover
- Frame transports the heat from the carrier to the cover
- The hottest components are coupled directly to the cover
- Cover transports the heat to an optional standard passive heat sink
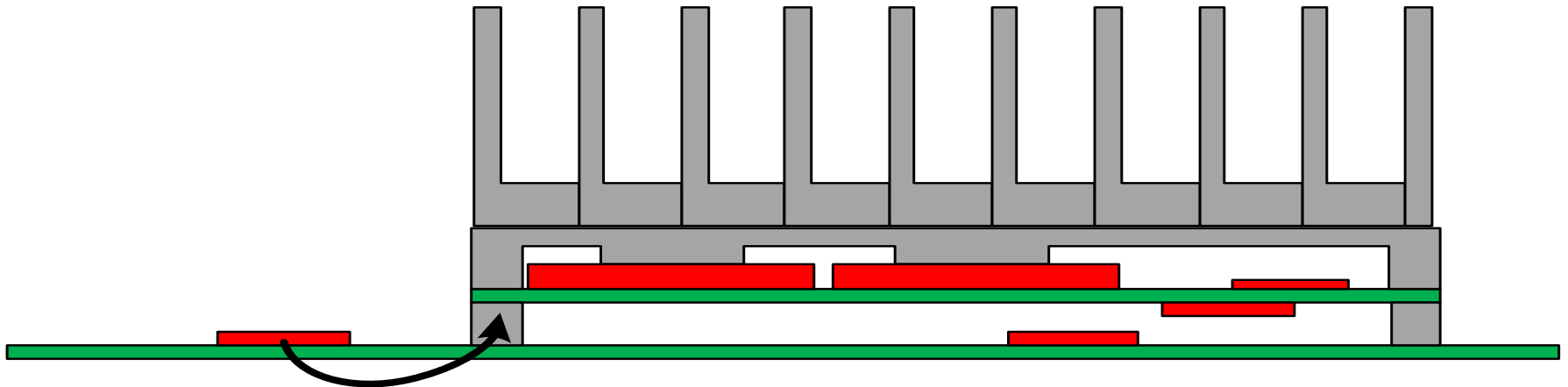
Thermal Concept for Conduction Cooled Boards

- Using the PCB helps to transport the heat to the frame
- The hottest components are coupled directly to the cover
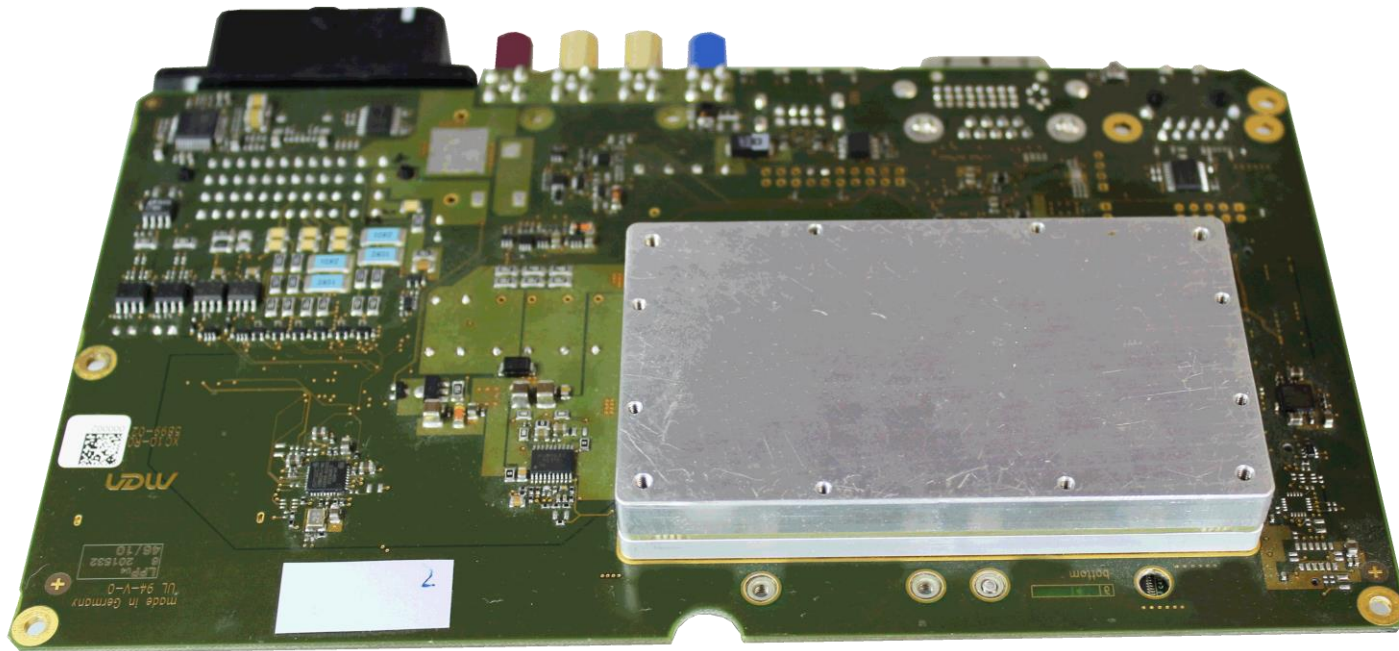- The cover transports the heat to the frame and to the wedge-locks
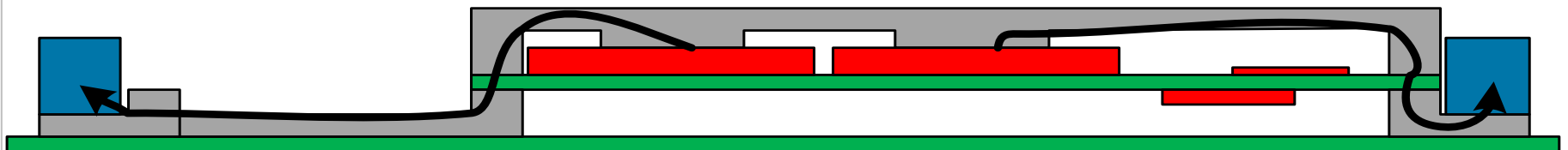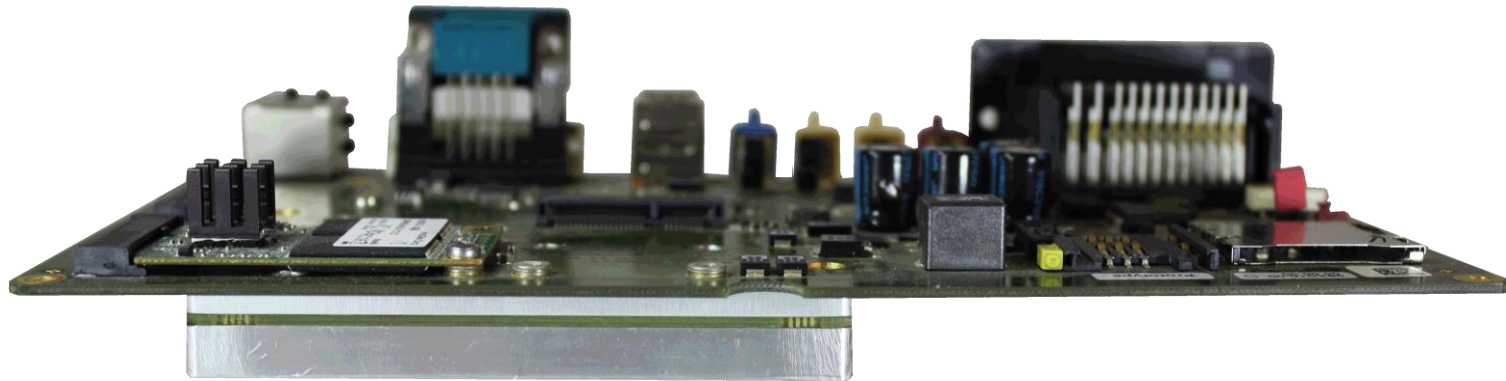
From Rugged COM to Rugged System
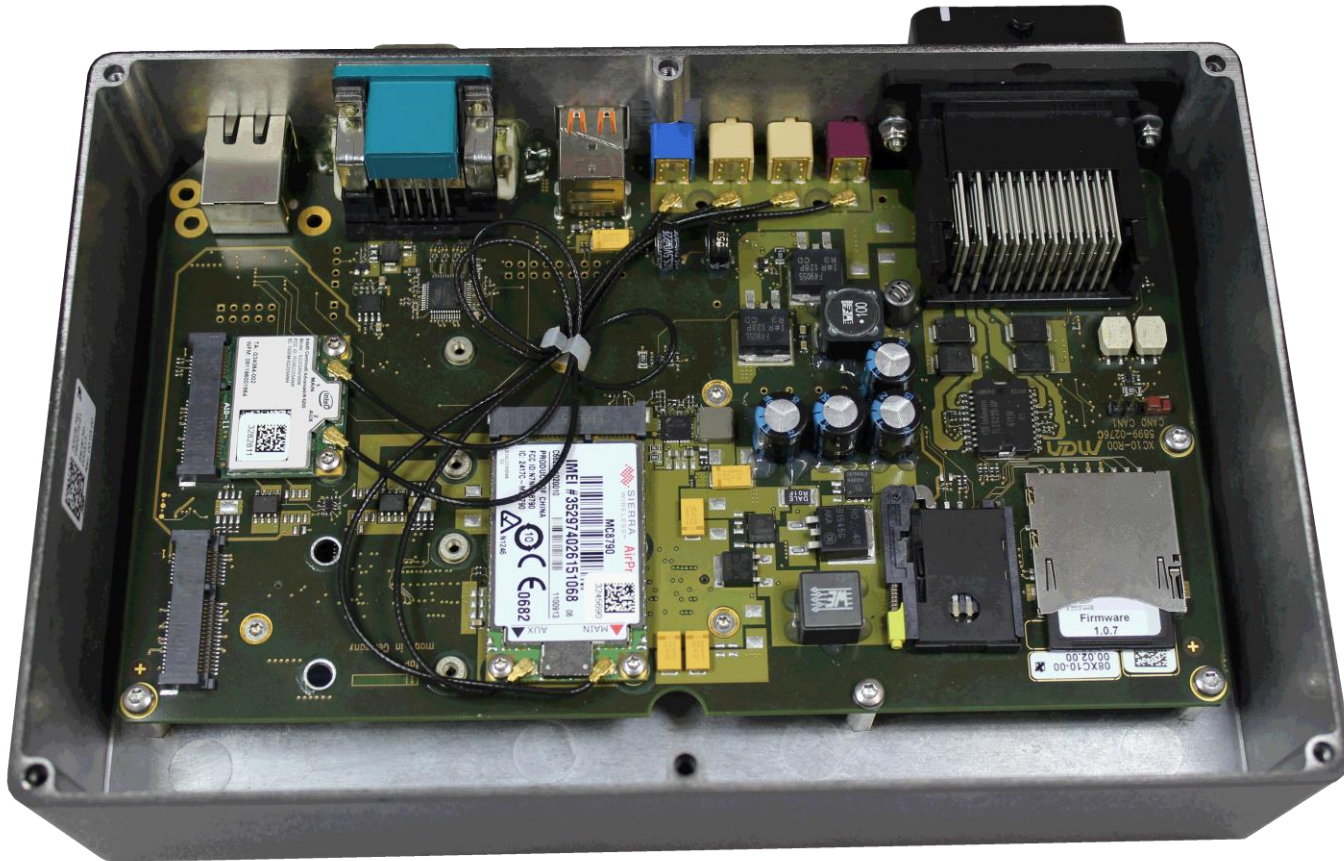
From Rugged COM to Rugged System

From Rugged COM to Rugged System

From Rugged COM to Rugged System

From Rugged COM to Rugged System

From Rugged COM to Rugged System

Rugged COM Express – Benefits

COM Express architecture

- Participate on high degree of familiarity and usage of COM Express modules
- Higher number of suppliers creates independence
- Two solutions with one design

VITA59 mechanics

- Thermal management   → extended temp., fanless use, conductive cooling
- EMC protection   → reduces risk, qualification cost
- Mechanical protection   → shock and vibration proof, rail/military approved
- Sealed   → Immune to humidity/dust