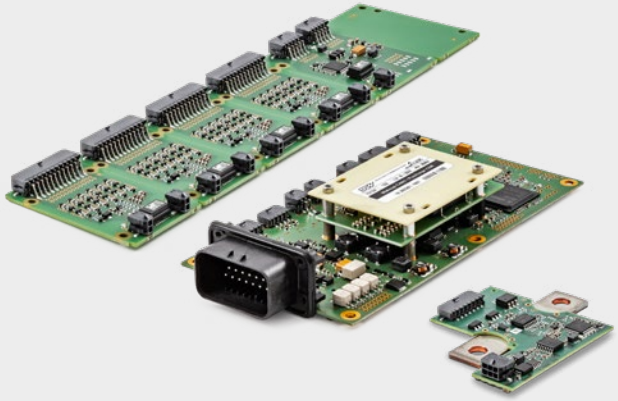
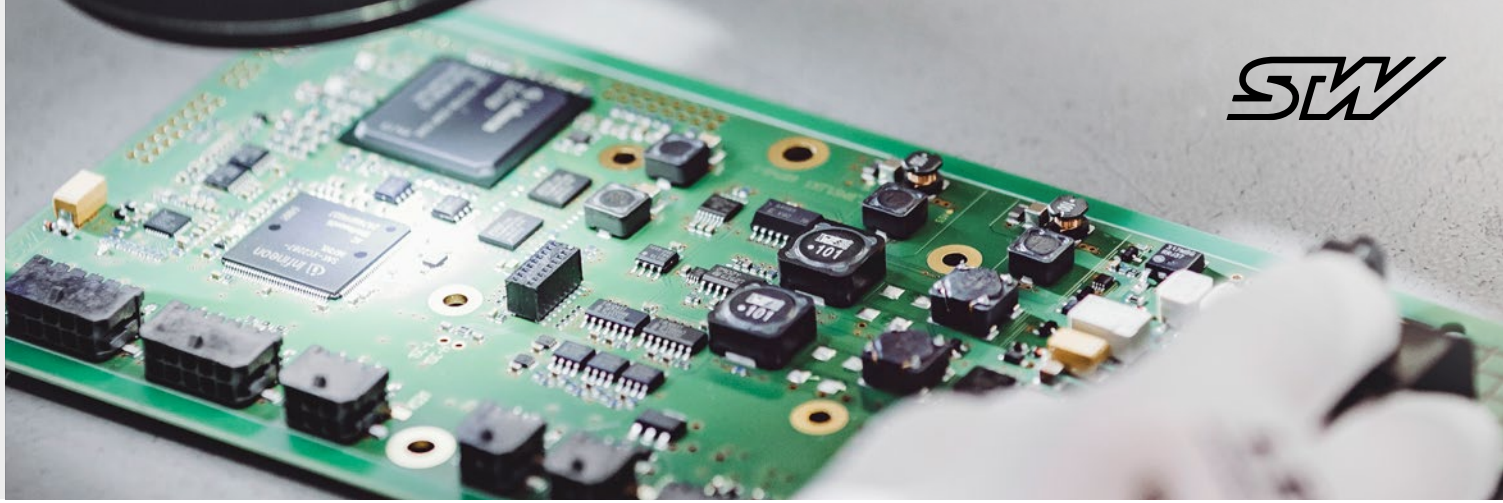




mBMS

Automotive electronics

KEY FEATURES

- For automotive grade High Voltage Batteries
- Scalable solution including Hard- and Software
- mBMS Toolchain, a set of PC based configuration and flash tools
- For all Lithium-Ion family members, incl. LFP, NMC and LTO
- Native support for parallel Batteries

TECHNICAL DATA

- Measurement of cell voltage and temperature
- Cell balancing
- Current measurement up to 2000 A
- Voltage measurement up to 800 V
- Isolation monitoring
- SOC, SOF (PP), SOH_{Ri} determination
- Auxiliary output lines
- Dedicated safety and application processors
- Vehicle interface (CAN busses, interlock generator/detector, KL15, KL30c)

ACCESSORIES

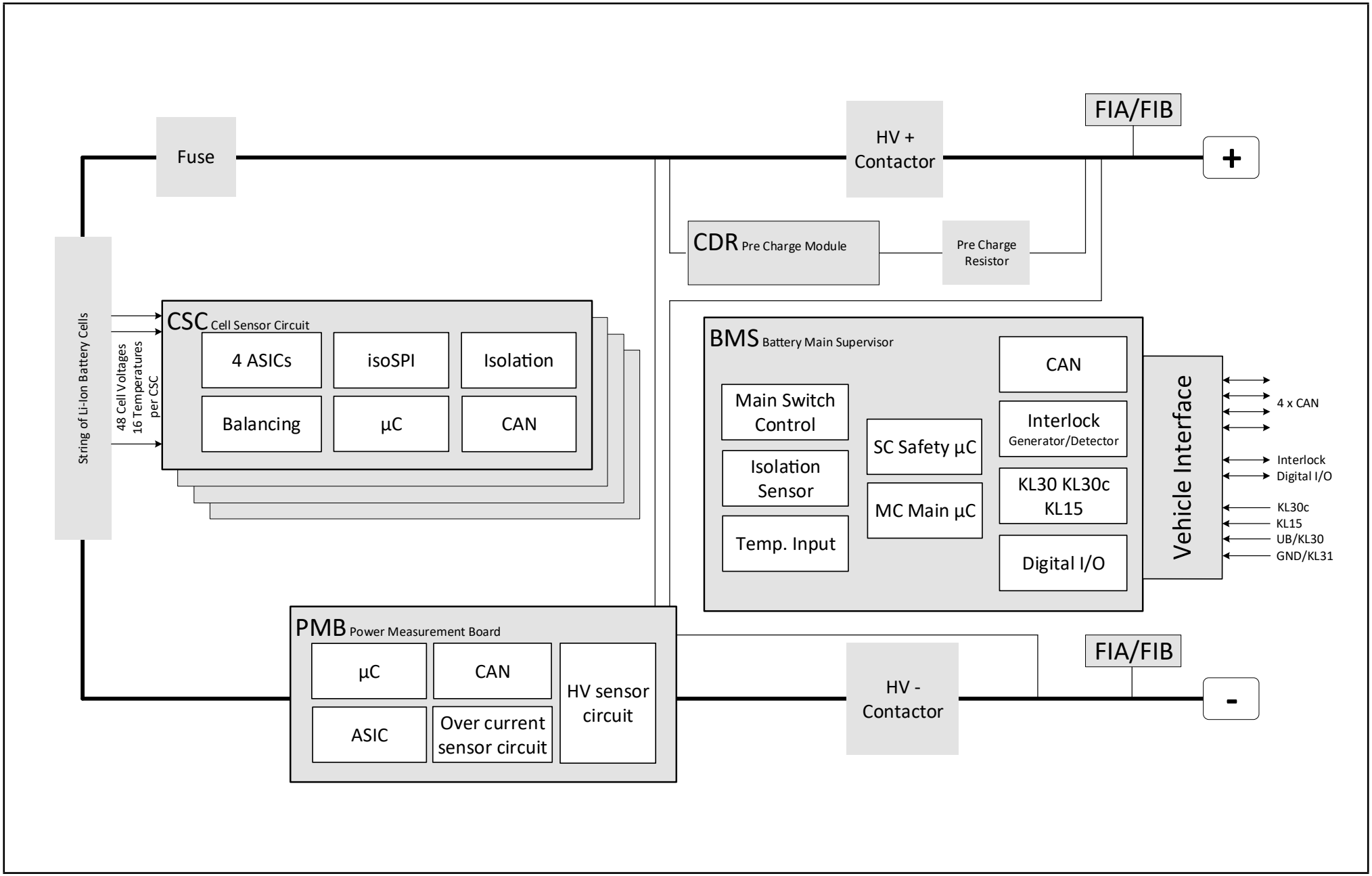
- EMC filter modules
- Pre-charge module
- Load resistor
- Main contactors
- Connector sets

Sensor-Technik Wiedemann GmbH

Am Bärenwald 6
87600 Kaufbeuren

+49 8341 9505-0
info@sensor-technik.de
www.stw-mm.com

BLOCK DIAGRAM



TECHNICAL DATA

External Interfaces (vehicle side)

LV Connector Type	23-pole AMPSEAL (TE connectivity)	
CAN	CAN 1 - ESS-CAN CAN 2 - Interpack CAN CAN 3 - Sensor CAN CAN 4 - SC-Meas CAN	CAN 2.0 B, 500 kBit/s
Interlock	detector and generator alternating current (±20 mA/88 Hz) reaction: enter safe state (main switch off) maximum external loop resistance: 350 Ω	

Internal Interfaces (battery side)

Connector Type	Micro-Fit (Molex)	
Indicators	on-board LEDs	
Cell voltage measurement	range: 1 V ... 5 V accuracy: 2.5 mV @ 2.5 V ... 4.3 V	⇨ CSC
Cell temperature measurement	NTC-Sensor, 10 kΩ, characteristics: EPCOS 8016, $B_{25/100}$ = 3988 K Range: -50 °C ... +125 °C (-67 °F ... 257 °F) Accuracy: 2 K plus sensor tolerance	⇨ CSC
Cell balancing current	120 mA @ Ucell = 3.6 V (derated at high temperature)	⇨ CSC
High voltage measurement	range: 0 V ... 800 V accuracy: offset 0.1 V, gain 1 %	⇨ PMB

Current measurement

	PMB1000	PMB2000	⇨ PMB
range	±1000 A	±2000 A	
accuracy offset	0.1 A	0.2 A	
accuracy gain	1 %		

Coolant temperature measurement	2 x input for NTC-Sensor 10 kΩ characteristics: EPCOS 8016, $B_{25/100}$ = 3988 K Range: -55 °C ... +125 °C (-67 °F ... 257 °F) Accuracy: 2 K plus sensor tolerance	⇨ BMS

Internal Interfaces (battery side)

Insulation measurement	between HV (battery) and LV (vehicle chassis) range: 1 ... 4500 kΩ accuracy: 0 ... -5 kΩ @ 1 ... 20 kΩ 0 ... -25 % @ 20 ... 1000 kΩ	⇨ BMS
Main switch control	2 x 1.5 A (hold current), 5 A (pickup current)	

System Data

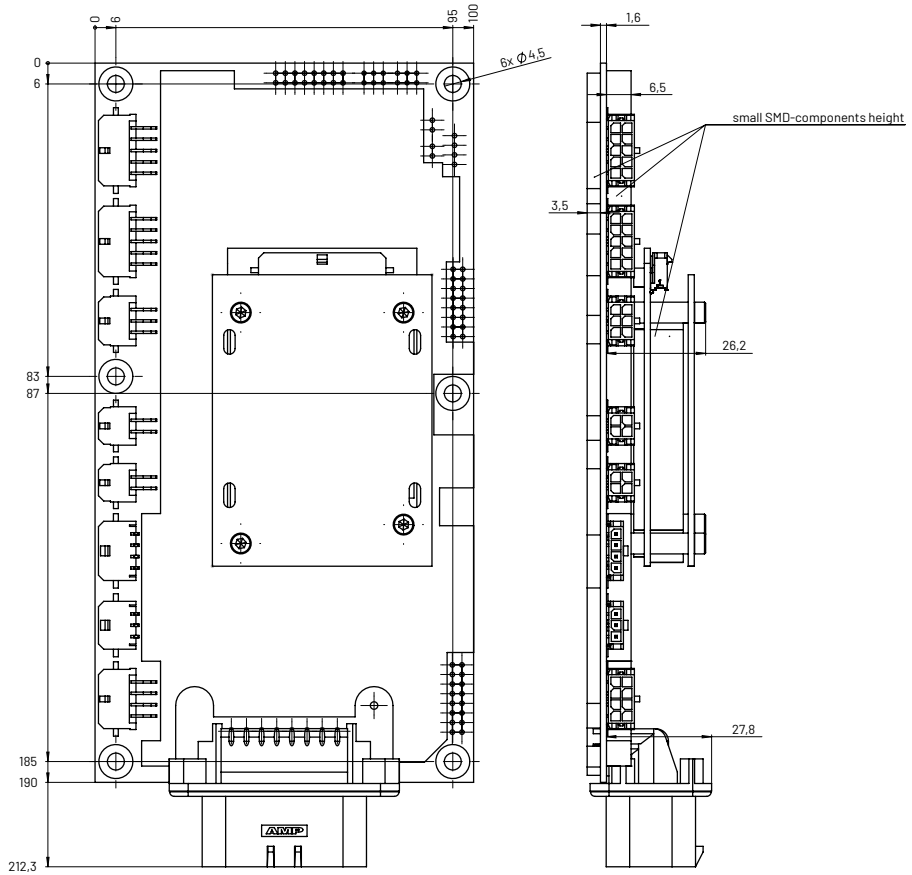
Wake up options	CAN1 or KL15	
Power supply	8 ... 32 VDC	
Current consumption (active mode)	350 mA @ UB = 12 V (main switches off) 185 mA @ UB = 24 V (main switches off)	⇨ BMS
	10 mA per CSC (supply from cells)	⇨ CSC
Current consumption (sleep mode)	< 100 µA @ UB = 12 V	⇨ BMS
	10 µA per CSC (supply from cells)	⇨ CSC
Dimensions (approx.)	BMS: 212 mm x 100 mm x 33 mm (8.3" x 3.9" x 1.3") PMB: 95 mm x 61 mm x 15 mm (3.7" x 2.4" x 0.6") CSC: 300 mm x 75 mm x 13 mm (11.8" x 3.0" x 0.5")	
Weight (approx.)	BMS: 0.23 kg (0.51 lbs.) PMB: 0.10 kg (0.22 lbs.) CSC: 0.26 kg (0.57 lbs.)	
Operating temperature range	-40 °C ... +80 °C (-40 °F ... 176 °F) ambient temperature	

DESCRIPTION

Battery Main Supervisor (BMS)

The BMS is the central control unit of the battery system. It includes three processors for highest levels of reliability and safety. It collects all information from the sensor modules, from the Cell Sensor Circuits and from the Power Measurement Board, calculates the status of the battery system and controls the HV contactors.

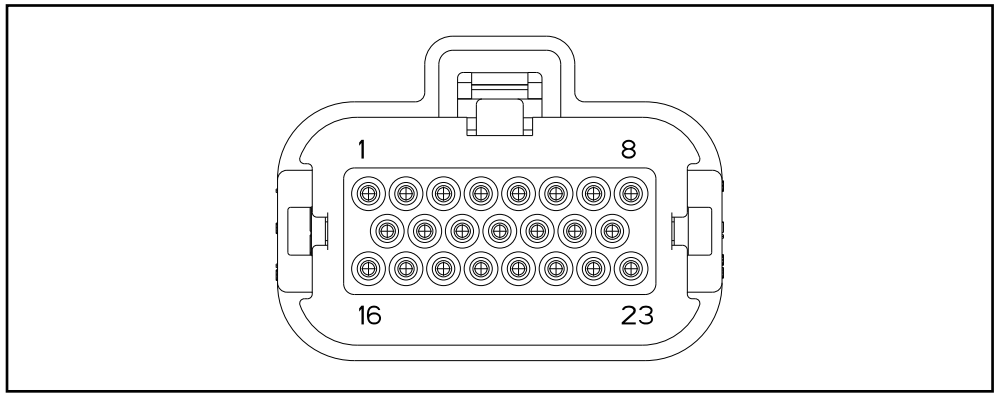
TECHNICAL DRAWING



PIN ASSIGNMENT

Pin assignment sorted by pin numbers

Pin	Designation	Description	max. Current
1	UB	power supply for ECU, KL30	0.4 A + current of Pin4
2	OUT1 (CFG0)	digital output 1 (LSS1) / analog input / master-slave-config.	2 A
3	OUT2	digital output 2 (LSS1) / analog input	2 A
4	OUT3	digital output 3 (HSS2) / analog input	2 A
5	n. c.	do not connect	
6	n. c.	do not connect	
7	IL_IN_LV	interlock loop (external)	0.02 A
8	IL_OUT_LV	interlock loop (external)	0.02 A
9, 10	GND	ground (LV), KL31	Return of Pin 1-3, 16-19
11	-	-	
12	CAN1_H	ESS-CAN (High)	
13	CAN2_H	Interpack CAN (High)	
14	CAN3_H	Sensor-CAN (High)	
15	CAN4_H	SC-Meas-CAN (High)	
16	KL30c	power supply for main contactors	cont. 3 A, inrush 10 A
17	KL15	ignition (high active input)	
18	IN1 (CFG2)	analog input 1 / master-slave-config.	
19	IN2 (CFG1)	analog input 2 / master-slave-config.	
20	CAN1_L	ESS-CAN (Low)	
21	CAN2_L	Interpack CAN (Low)	
22	CAN3_L	Sensor-CAN (Low)	
23	CAN4_L	SC-Meas-CAN (Low)	

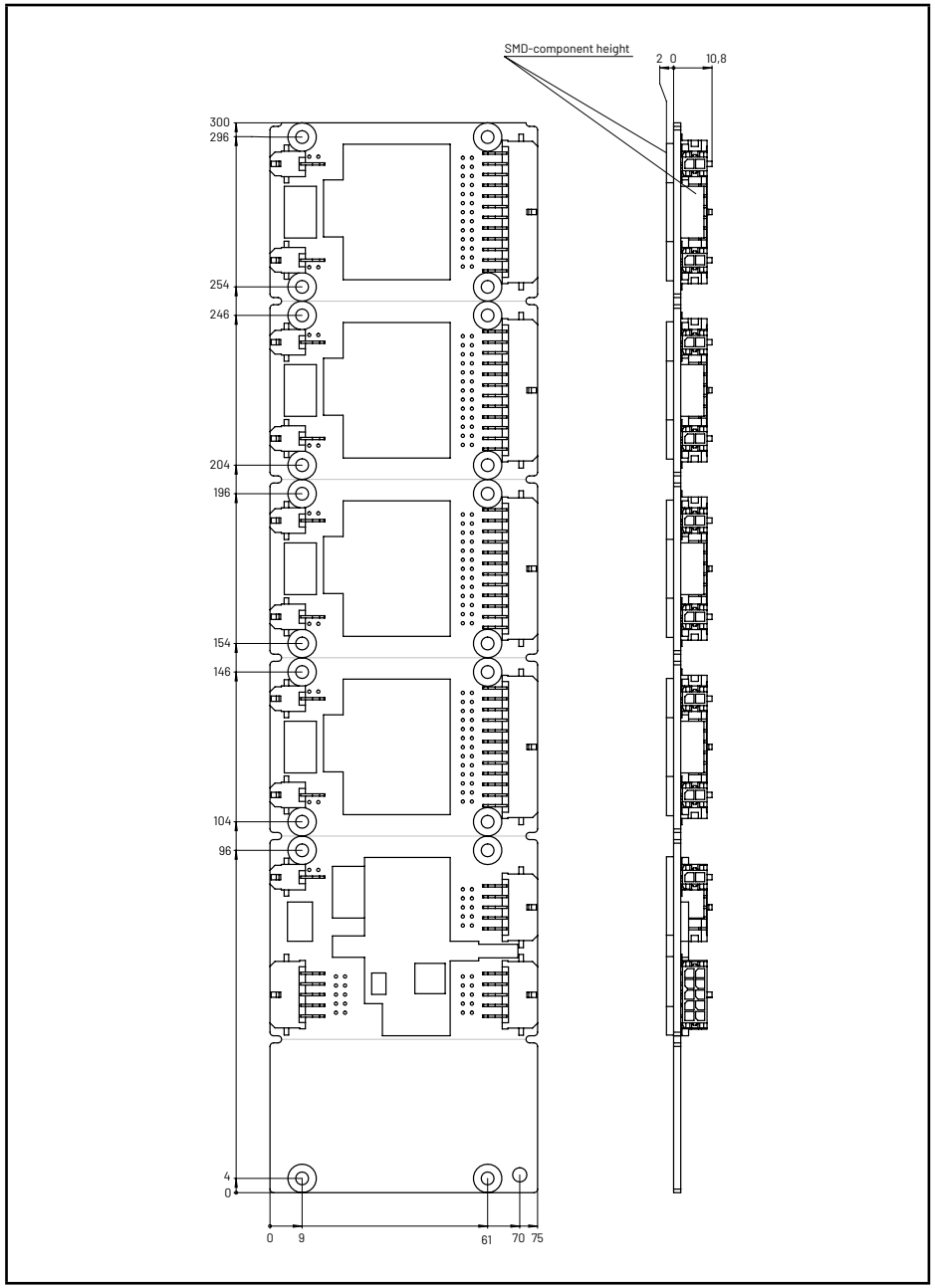


DESCRIPTION

Cell Sensor Circuit (CSC)

The CSC supervises the individual cells of the battery by measuring voltage and temperature. Each CSC is equipped with a passive discharge path for balancing the charges of the battery cells.

TECHNICAL DRAWING

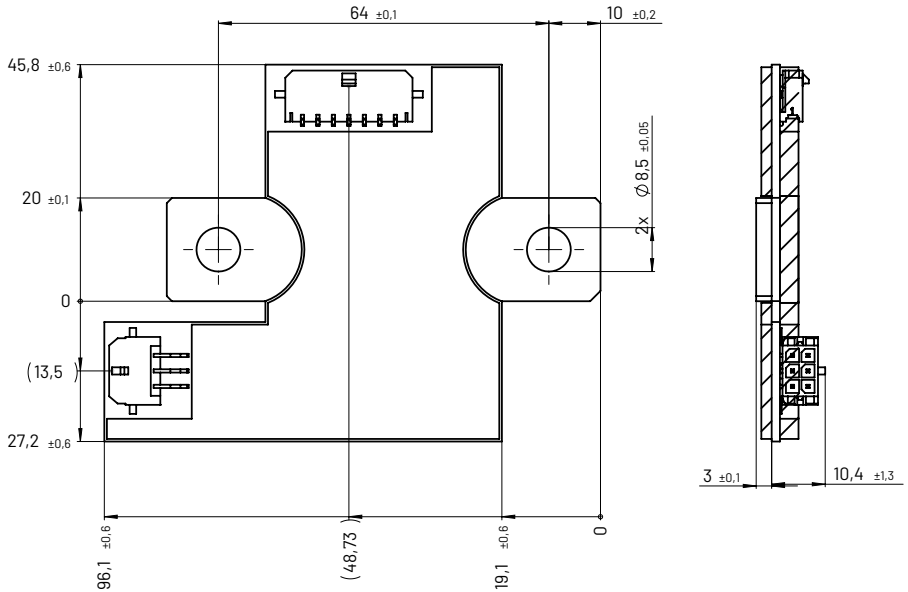


DESCRIPTION

Power Measurement Board (PMB)

The PMB measures the current (shunt resistor) which flows in or out of the battery, the high voltage value of the battery stack and the traction net. The PMB is equipped with a unique redundant safety circuit which enables the PMB to directly signal a current limit violation.

TECHNICAL DRAWING



SOFTWARE

mBMS Toolchain

Configuration

Configuring the mBMS to suit your application.

Safety parameters	Define and manage system security limits
Application parameters	Illustration of cell characteristics Define the battery application strategy

Update

Software update of the complete energy storage system (ESS)

One-Click-Update	Simple and convenient system administration through automatically configured update packages.

Diagnosis

Allows easy and quick commissioning of the energy storage system (ESS)

Battery data	Running mBMS functions and displays battery data
Failure diagnosis	Supports fault diagnosis by visualization

Safety Functions

Cell Level	Battery enters safe state in the events of cell over voltage, under voltage and over temperature.
Battery Level	Battery enters safe state in the event of over current.
System Integrity	Isolation resistance is monitored.
	Interlock signals associated with HV and LV connections are detected and generated.
	A multitude of built in self test and diagnostic routines are performed.

mBMS Toolchain

Management Functions

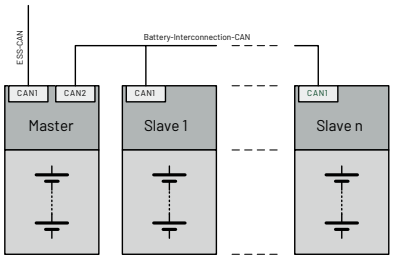
Balancing	Passive balancing towards a determined voltage target is performed on vehicle-request.
Pre Charge	Traction net capacitors are pre charged before the battery is switched on.
Battery State Determination	SOC: state of charge is determined by means of coulomb counting.
	SOF (PP): available power is determined for charging and discharging.
	SOH_{Ri} is determined by impedance tracking of a pack.
	SOH_{MSW}: Main switch ageing is tracked.

Energy Storage Systems (ESS)

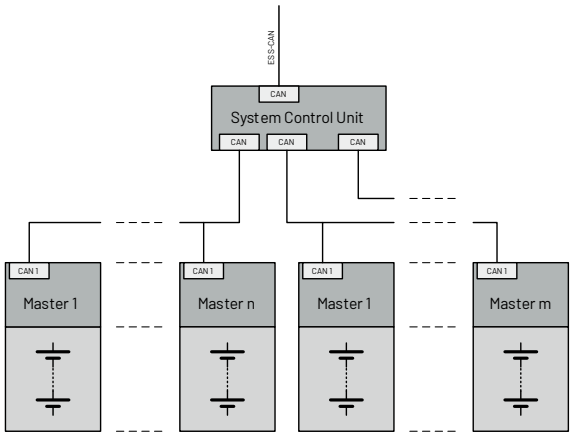
Parallel Packs	An ESS may be built up by up to eight parallel packs in Master Slave topology
	An ESS may be built up by an arbitrary number of parallel packs may build up in Multi Master topology
Parallel Cell Strings	Large battery packs built up by strings of parallel cell modules are supported.

TOPOLOGIES

Master/Slave Networking - Parallel Packs:



Multi Master Networking – Parallel Packs:



Parallel Module Architecture: